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Index to Advertisers—Page xi.

Principal Contents:

	PAGE
Development at Bradford	415
The Characteristic Curve. By R. B. Rowson	419
Domestic Water Heating. By H. E. White	421
Demagnetising and Demagnetisers. By H. E. Hutter	422
Electrical Manufacturing in 1937	423
The Fulham Power Station	426
Meetings and Discussions	427
Correspondence: The E.D.A. Salesmanship Course; Change-over Questions; Overhead Line Construction; Concrete Poles in Rural Areas; Applying for an Appointment; I.E.E. Membership Regulations	429
New Apparatus and Devices	431
Grid-controlled Traction Rectifiers	432
The E.C.A. and the Ironmongers	433
Parliamentary News	434
Business and Industrial Notes	435
Electricity Supply	439
Traction	441
Contract Information	442
Notes	443
Our Personal Column	444
Financial Section	445
Published Specifications	449
New Work for Contractors	450

The Electrical Industry's Spearhead

E.D.A.'s Good Record

ALTHOUGH the contributions received by the British Electrical Development Association may not yet be commensurate with the size and importance of the electrical industry, the revenue has shown a remarkable growth in the last few years.

For this the Central Electricity Board is to be thanked, for it is now contributing £50,000 a year—the maximum under existing arrangements. Of course, the larger income is derived from the same source—that is, the supply undertakings—but it is a more painless extraction than if they were paying directly to E.D.A. about double the amount of their present subscriptions. It is a comforting thought that the Board's subscription is derived from non-members as well as members of the Association. To this extent the recalcitrants are forced to contribute their share towards the cost of work from which they derive benefit.

It is safe to say that half a dozen years ago very few of the public knew E.D.A., for the very infrequent advertisements which the Association was able to insert in the public Press could not be expected to leave a lasting impression. The essence of advertising is persistence: a name or a product has to be constantly drummed in if continuous results are to be obtained. Nowadays, we suppose, the larger part of the population is aware of E.D.A. and what it stands for. "I'm Electric" can now look "Mr. Therm" in the face without feeling insignificant.

Another way in which E.D.A. is coming before the public more and more is in the direction of exhibitions. The manifold services of electricity make the participation of E.D.A. appropriate on practically any occasion of this kind. With funds still limited it is totally impossible for the Association to have a display at every show but it is taking part in a surprisingly large number, and its stands are invariably a credit to it and create a most favourable public impression.

It is responsible for the very excellent displays arranged in connection with I.M.E.A. Conventions, and among the many other efforts in the exhibition field the displays at Royal Agricultural Shows are outstanding. Over 500 kW of cooking equipment was included in the catering arrangements at the Wolverhampton Show. The Association, jointly with other organisations, will have an imposing pavilion in the Empire Exhibition, Glasgow, but its greatest effort is yet to be made—the organisation of the National Electrical Exhibition proposed for 1940.

The development of the Association's technical activities is a notable feature of the annual report. "Technical" is, perhaps, hardly the correct word; "practical" is probably more appropriate. The work consists largely of producing booklets for the use of sales staffs dealing with particular applications. They contain enough technical information to enable salesmen to understand the considerations involved in the design and use of appliances. A first series of eight sections bound in a convenient loose-leaf folder has been produced.

The activities of the committees on special subjects continue to produce valuable results in the shape of facts and figures for the conversion of more and more people to the electric way. There are now five specialists in technical development, experts on street lighting, transport and power having joined the staff during the year.

There was an excellent response to the institution of the salesmanship course; about a thousand candidates sat for the first certificate examination and 400 others are expected to take the next exam.

It used to be thought that electricity sold itself. So it does to some extent, and even before the advent of E.D.A. there was a steady increase. But the increasing influence of that live development organisation has undoubtedly been the principal factor in the swift advance of recent years. The money thus invested has been repaid considerably more than a thousandfold. But better than money has been the hard work put in by the staff of E.D.A. and the noble band of voluntary workers for the cause.

A Good Year

As was to be expected, the B.E.A.M.A. report for 1937 is the best for some years. Greater activity in the home and export markets has led to increased employment, and (although it is not actually stated) better financial results, judging by the reports of various members of the Association. There are, of course, one or two flies in the ointment, for ours was never a perfect electrical paradise. Raw material price fluctuations are a constant source of worry to manufacturers. These, however, are mainly due to international causes. It is otherwise with the placing of orders. At the Association's annual dinner last November Sir Felix Pole urged that supply authorities, acting together with Government help, should endeavour to spread their orders over a period to even out the load upon manufacturers' works. The report reverts to this subject, and considers such a course feasible. Imports are another thing: it is certainly anomalous that the second greatest electrical exporting country should also hold second place as an importer.

Trade Associations

At last week's dinner of the Electrical Wholesalers' Federation Mr. V. Watlington, Director of B.E.A.M.A., stressed the value to an industry of strong associations. There will be general agreement with this, for an industry in a state of anarchy is in danger of falling to pieces. The public may "benefit" temporarily by a flood of cheap apparatus, but the chances are that the firms who produced or sold that apparatus will disappear, and with them that "service" which the buyer expects. The speaker also made mention of those who are willing to enjoy the fruits of association without paying for them. Such people are a menace, for they do not hesitate to go against the real interests of their industry when it suits their book to do so. Then there are those who join an association, and, like the outsiders, are content to derive benefit from other people's efforts. They take no active share in the work until they think that something is wrong, when they loudly call for heads on chargers. There is not much to choose between these two undesirable classes.

Coal Prices

The murmurings of coal consumers —particularly public utility undertakings—have led the Government, somewhat belatedly to set up a Departmental Committee to investigate the matter. This body will be asked to inquire into the organisation and methods of distribution of coal and its derivatives, and to investigate the various items which make up the differences between the prices received by the producers and those paid by the consumers. This gives the Committee plenty of scope, for the disparity, on the face of things, appears to be extraordinarily wide. We hope that the investigation will lead to an unburdening of the supply undertakings, who have begun to talk about the probable effect of the ever-increasing cost of coal upon the price of the unit.

Gas-washing Costs

At least two base-load electricity generating stations on the River Thames are equipped for the burning of coals of similar characteristics. Should this practice extend, it would tend not only to increase the price, but also cause a shortage of a particular class of fuel. Hence the note of warning introduced into the paper on the new Fulham plant read at the Institution of Civil Engineers this week. The authors consider that both stokers and fuel-conveying system should widen rather than restrict the range of sizing of the coal which can be utilised. At the same time this requirement must be reconciled with the necessity to select a high calorific value and small sulphur content to relieve the flue-gas cleansing equipment, which at Fulham appears to have behaved excellently and to be somewhat cheaper than the Battersea installation. Nevertheless, gas-washing at Fulham has cost £1.282 per kW installed, or £1.521 when allowance has been made for the increased structural cost. The steam-raising and mechanical plant, which differ from the normal in respect of super-heating, feed heating and pump driving, have accounted for 32.3 per cent. of the total expenditure, whereas the electrical equipment represents 8.86 per cent. It appears that so far sulphur extraction has cost approximately 10 per cent. of the total works cost, or 0.0144d. per kWh generated, while the authors confidently anticipate that the first year's total cost of 0.1444d. per kWh will be materially improved upon.

Ironmongers and Contractors

The Ironmongers' Federated Association and the Electrical Contractors' Association are still unreconciled upon the question of retailer organisation. According to their individual lights both are right and we have the spectacle of two rights making a wrong. The E.C.A. claims to represent the "legitimate" electrical retailer, a large proportion of its members being dealers as well as contractors. The I.F.A. maintains that ironmongers were the earliest retailers of electrical appliances, but they are still primarily ironmongers and should be organised as such, while their electrical interests are looked after by the Association's Electrical Section. The E.C.A. seeks, however, to spread its net wider and gather in all electrical dealers whether they belong to one or other of the Associations or not. The ironmongers refuse to be gathered in but suggest the formation of a joint committee representing the two Associations to regulate the trade in their common interest. It would appear that such a plan should not prevent the E.C.A. from proceeding with its recruiting for the National Association of Electrical Retailers outside the ironmongers' ranks and would tend to some degree of regularisation in a branch of the electrical industry in which regularisation is very desirable in the interests of the trade itself and of the purchaser of appliances.

Rectifiers for Transport

Perhaps we should not be very thankful for the successful development of rectifiers if it meant only the perpetuation of d.c. distribution. There is little chance of this happening to any material extent, however, and this aspect of d.c. engineering is likely to remain a small one. For rail and road transport rectifiers have potentially a very much wider sphere of usefulness, and the claim made by Dr. W. G. Thomson in his I.E.E. paper last week that they have had a far-reaching influence on transport is easily demonstrated. Progress in railway electrification and in trolley-bus systems owe, and will no doubt owe still more, to this method of conversion from a.c. to d.c. Although the Ministry of Transport Railway Electrification Committee recommended in 1927 the adoption of 1,500 V with overhead equipment as a standard, provision was made for 3,000-V operation in special cases, and this would appear to be applicable to main-line schemes in this country, judging from experience abroad. If liberally rated, rectifiers at this voltage have shown themselves quite capable of dealing with the most onerous conditions likely to be imposed by a traction load.

Enlightening the Shareholder

Following Sir Bernard Greenwell's speech at last Tuesday's annual meeting of the County of London Electric Supply Co., Ltd., a film was shown of the Barking power station illustrating the progress made by the company during the past fifteen years, with explanatory comments by Sir Bernard. Few shareholders can spare the time to visit their property, and this graphic method of acquainting them with the activities of the concerns in which they hold investments is a very useful one.

Developments at Bradford

Air-raid and fire precautions

H.p. steam plant operation; conversion of boilers to retort firing; automatic boiler control; and new switch houses

A FEW years after its installation, the h.p. boiler and generating plant at the Valley power station, Bradford, is still of outstanding electrical interest because, since overcoming the "teething troubles," the "experiment" has been justified by the results obtained. Further, many electrical men think it a pity that the development has not been followed up, for the scheme is still the only "straight generation" one in this country for anything like such a high steam pressure. By the courtesy of Mr. T. Roles, city electrical engineer and manager, we were recently given the opportunity of seeing this plant under normal running conditions and were given access to the log-sheet results from which the table at the end of this article was compiled.

Steam at 1,100 lb. per sq. in. from the boiler drum is conveyed through the superheater where the temperature is raised to about 850 deg. F., and then through the h.p. turbine, where the pressure is reduced to 210 lb. per sq. in. and the temperature to about 520 deg. F. A yield of about 2,500 kW is obtained from the high-pressure set as the result of this reduction.

After leaving the exhaust end of the h.p. turbine the steam is led to a receiver, a portion of the steam being tapped en route and taken to feed heaters which are designed to raise the temperature of the feed water from 160 deg. F. to 300 deg. F. A branch from the turbine inlet 1,000-lb. per sq. in. steam line leads through a reducing valve direct to the receiver.

The reducing valve is designed to deal with the whole of the boiler output in the case of emergency. It is arranged for manual or electrical operation, and when under electrical control it may function automatically as an excess pressure regulator or at the will of the operator it may be opened or closed to any predetermined amount of by-pass. The valve is interlocked with the turbine overspeed trip gear. The boiler plant was supplied by Babcock & Wilcox, Ltd., the turbine and the reducing valve by the English Electric Co., Ltd., and the reducing valve electrical gear by James Tate & Co., Ltd.

The receiver is fitted with desuperheating spray nozzles, so that in the event of the reducing valve coming into operation the temperature of the steam will be maintained at a figure of about 520 deg. F. The importance of this lies in the fact that the steam is led from the receiver to a reheater integral with the boiler and designed to raise the temperature of the steam from 520 deg. F. to 750 deg. F. The reheated steam is then led to the station 200-lb. pressure line, from which it feeds in the ordinary way the l.p. turbines.

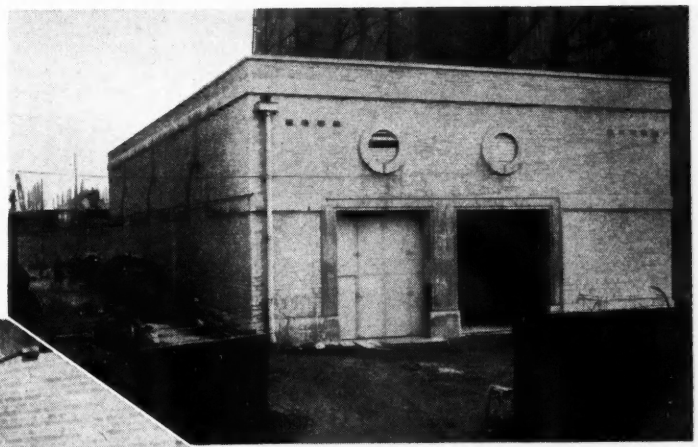
The troubles encountered during the earlier periods of operation were mainly bound up with the question of feed-water treatment, and we emphasise that practically no difficulties have been experienced with the operation of the valves and fittings either as regards operation or deterioration, the maintenance costs being very low—certainly no more than in the case of the l.p. plant.

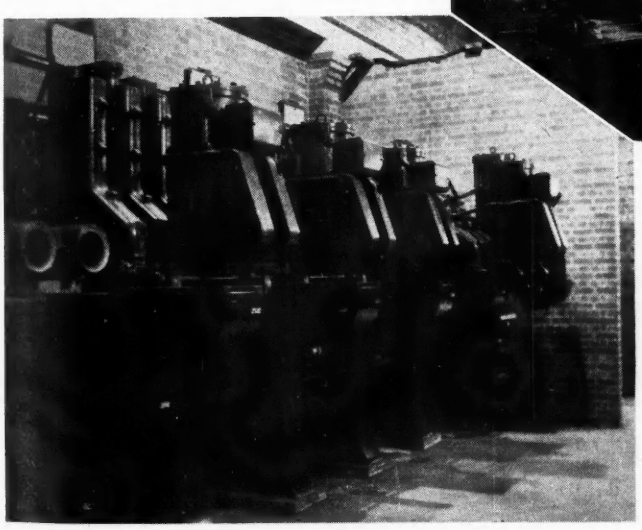
By selecting the comparative figures from two recent log sheets, one for a week during which the h.p. plant was in commission and one when that plant was not running, a good indication of the working results is given, as the table shows.

Boiler-firing Conversion

The four boilers in No. 4 house were originally 65,000-lb. per hr. C.T.M. units with travelling-grate forced-draught stokers. Consequent upon the necessity to increase the steaming capacity of the boilers, coupled with the need for extensive repairs on the stokers, and with the increasing number of grades of fuel supplied to the station, the existing stokers were replaced by Taylor retort equipments. The normal rated output of the boilers was thereby raised to 80,000 lb. per hr. with very little increase of the stack temperatures. This programme was carried out over an extended period and the results obtained have justified the departure from travelling-grate practice. Maintenance on these stokers compares very favourably with that on any of the travelling-grate equipments, and the performance under the imposed variable-quality coal conditions is entirely satisfactory.

As the result of experience gained from equipping six small boilers for automatic firing control the four boilers in No. 4 boiler house have also just been so equipped. It was thought that automatic control in conjunction with the retort stokers might prove to be a very desirable combination in that the inherent increased reserve of heat normally peculiar to the retort type of stoker would materially assist in producing satisfactory results. Although the scheme is not yet complete in every detail the improvement in results so far obtained has been very marked. The boilers are also served by Cope's automatic feed-water regulators which, although they are not of the most modern design, contribute considerably towards the success of automatic working.





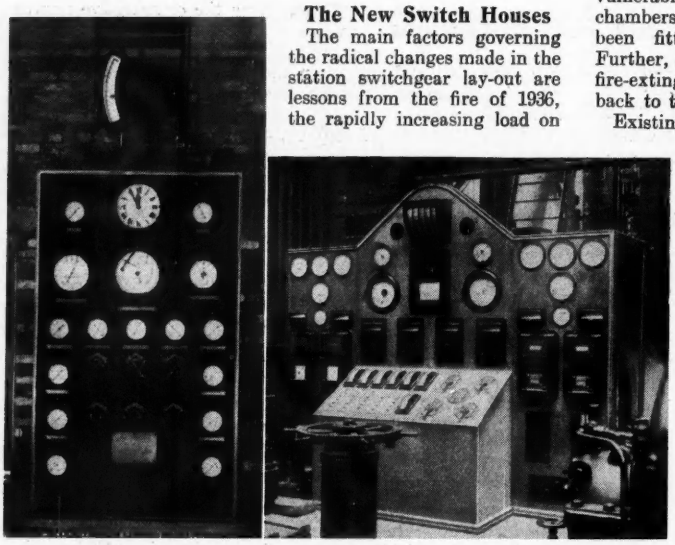
Above: The new switch houses; one now under construction. Left: Interior of completed switch house showing flash barriers

It was demonstrated to us that the firemen could be removed from the boiler house entirely, and we remained in the house for a considerable period while the load on the station was varied between 52,550 kW and 47,000 kW. The automatic installation carried out all the operations necessary for reducing and increasing the output of the boilers as required without any variation of the steam pressure.

One of the factors which induced the undertaking to adopt automatic control is the possibility of air raids. It is confidently expected that when the remaining boilers are working with automatic control the whole of the boiler plant may, in the event of air raids, be left unattended for lengthy periods. The new boilers which are on order are to be equipped for a similar type of automatic control.

The control apparatus was supplied by James Gordon & Co., Ltd., and is operated by compressed-air impulses which adjust

the dampers and stoker speeds according to the steam pressures imposed on the master regulator.



Left: Control panel for automatically fired boilers. Right: H.p. boiler control equipment

The New Switch Houses

The main factors governing the radical changes made in the station switchgear lay-out are lessons from the fire of 1936, the rapidly increasing load on the 6,600-V system, and the necessity to take steps to ensure as far as possible continuity of supply under war conditions. It was found that the installation of a 33,000-V system was not only necessary technically, but that it would also help materially in meeting possible eventualities of air raids.

To ensure that in the event of the destruction of one section of the switchgear the other sections would remain unaffected new and separated switch houses have been and are being built with a lay-out such that should any unfortunate occurrence like that of 1936 again take place in one house the trouble would be confined to that house only. All the cables from these new switch houses have been led direct into separate cable passages which are entirely apart from the switch house itself. The flash barriers which were installed in the old switch house proved so effective at the time of the disaster in sectionalising the fire actually in the switch house that similar flash barriers have been installed in the new switch houses.

A new control room is also being erected at a considerable distance from the power station buildings. This is so designed that the attendants would be able to continue at their posts in comparative safety during bombing and gas attacks.

All the existing and projected switch houses are and will be protected by automatic CO_2 fire-fighting equipment, and all vulnerable points round the power station, such as transformer chambers, turbine governor gears and turbine basements have been fitted with "Mulsifyre" fire-protection apparatus. Further, certain vital cable ducts have also been equipped with fire-extinguishing equipment, with warning indicators carried back to the main control room.

Existing facilities for dealing with road-borne coal at the main entrance to the station have become inadequate, so a separate handling system is being provided complete with duplicate weighbridges. From the new receiving hoppers a belt conveyor will carry the coal to other hoppers in the power station or the coal may be stacked by means of a drag-scraper on the adjacent land previously occupied by an old dye works. The storage capacity of this land is about 4,000 tons. An automatic skip hoist is being provided to raise the coal from the hoppers to the various bunker levels, and from the central tower of the hoist, coal will be distributed to the h.p. and Nos. 3 and 4 boiler houses.

We are indebted to Mr. Roles and to his assistants for the help afforded us during a recent visit in preparing this article.

WEEKLY LOG-SHEET EXTRACTS.

	H.P. Plant in Commission.	H.P. Plant not Running.
kWh generated	5.65 million	4.65 million
Load factor	55.71 per cent.	54.5 per cent.
Overall efficiency	19.33 per cent.	17.99 per cent.
Boiler-plant efficiency	h.p. 85.85 per cent. l.p. 74.54 per cent. Combined 76.36 per cent.	74.24 per cent.
Turbine-room efficiency ...	l.p. 24.31 per cent. Combined 25.31 per cent.	24.23 per cent.
Steam consumed per kWh ...	10.71 lb.	11.43 lb.
Coal consumed per kWh ...	1.484 lb.	1.559 lb.
Calorific value of coal (gross as received)	11,900 B.Th.U.	12,170 B.Th.U.

During the week the h.p. plant was in commission, the output from the h.p. boiler supplied 21 per cent. of the total units generated. The figures with h.p. plant in commission and h.p. plant not running given in the table indicate the improvement which could be effected if the plant was fully compounded.

Forced-air Circulation Furnaces

FOR the tempering of steel parts electric furnaces embodying the principle of forced-air circulation have of late years to a very considerable extent replaced baths, whether oil, salt, or lead. Heat transference at low temperatures depends greatly upon convection currents (radiation playing little part at temperatures below 500 deg. C.) and when the circulation is increased by a suitable fan, as in the case of forced-air circulation furnaces, the rate of heating is correspondingly increased.

Although the advantages of such furnaces are widely recognised, as evidenced by the increasing numbers in use, figures relating to actual results are not so numerous as in the case of other metallurgical processes involving higher temperatures and correspondingly higher energy consumption.

A record has recently been taken by the A. C. Nielsen Co., of New York, of the results obtained with a 27-kW electric furnace of the forced-air circulation resistance type working at 405 deg. C., which is used for tempering large quantities of chain-belt components. This furnace has a working chamber 22 in. in diameter by 26 in. deep, and the heating elements of nickel-chromium wire are mounted in a separate chamber together with the fan. The shaft of the latter is supported in exterior air-cooled bearings mounted on the walls of the furnace.

The work treated consisted of bars and plates, with a considerable quantity of link pins, the weight of the individual parts varying from 1 to 55 lb. A usual weight of charge is in the neighbourhood of 600 lb., and the basket containing it is lowered into the furnace by means of a chain hoist, the operation of removing one load and inserting the next occupying about five minutes. The furnace operates for 22½ hr. per day, as it is shut down for 1½ hours during the period of peak load of the plant, and the attendance required is 5¾ man-hours per day. Records taken over ten days' continuous working under these conditions gave the following results:—

During the period mentioned 74,029 lb. of steel, averaging 329 lb. per hour, was treated. The total consumption of electricity was 3,141 kWh, or 13.96 kWh per hour, giving 42.43 kWh per 1,000 lb. of steel. With electricity at ½d. per kWh the cost of power was 1s. 9d. per 1,000 lb. of steel and the overall cost was less than 4s. 6d.

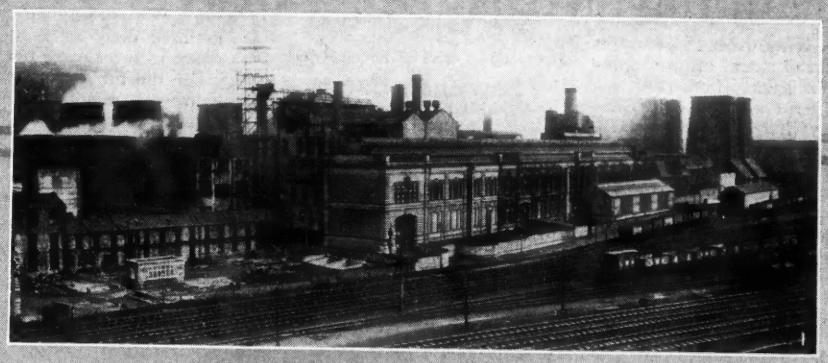
The capital cost of the furnace, including automatic control and erection on site, was £577. On the basis of a ten-year life, depreciation amounts to £57 14s. per annum and interest at 6 per cent., less interest earned by depreciation reserve fund, to £19 10s. Other annual fixed charges are floor space (80 sq. ft. at 2s. 1d.) £8 6s. 8d., and repairs, stores and maintenance £37 7s. 4d., making a total of £122 9s.

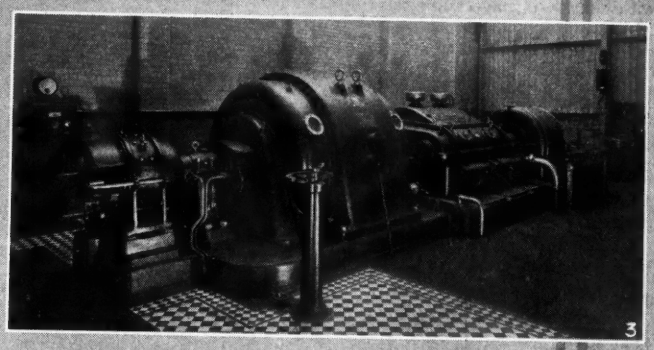
Daily operating costs were: Fixed charges (£122 9s.÷350), 6s. 11d.; power for elements and blower, 13s. 1d.; labour, 5¾ hour at 2s. 5d., 13s. 10d.; total, £1 13s. 10d.

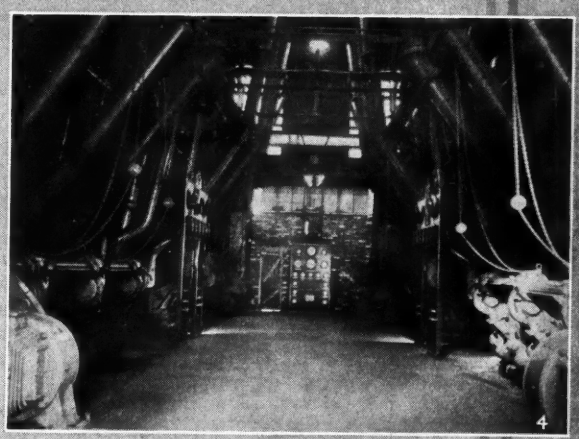
The lowest output for any one day was 4,050 lb., and the highest 8,850 lb. In the figures quoted the cost of labour is given at the American rate, which is considerably in excess of English, and both consumption and labour costs are on the "safe" side. The figures are thus based upon actual practice over a reasonably prolonged period, during which over 33 tons of steel parts and components were successfully treated.

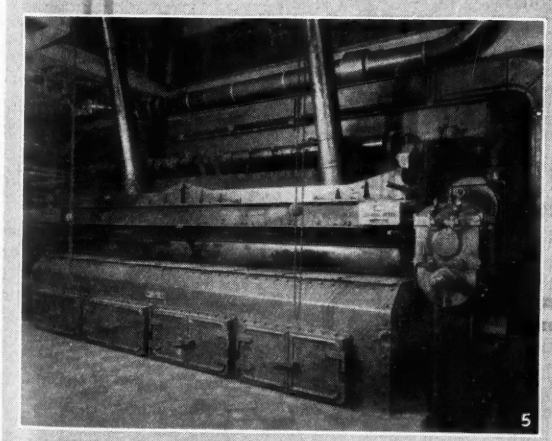
Gate-end Boxes

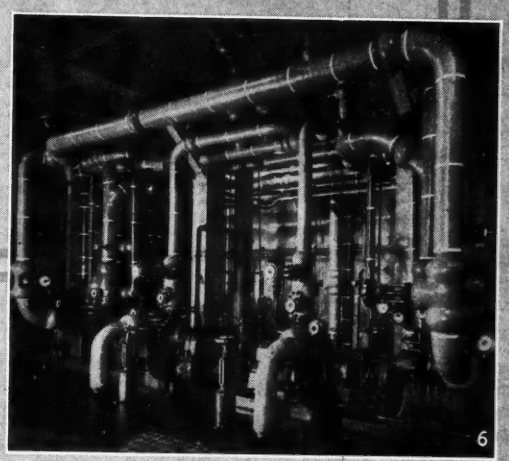
The British Standards Institution has just issued a specification for flameproof air-break electrically operated gate-end boxes (B.S. No. 787-1938). It covers designs for use on three-phase a.c. circuits up to 650 V in controlling and protecting coal cutters, conveyors, loaders and similar equipment. The specification defines the various items referred to and then goes on to deal with standard voltages and size, design and construction, temperature limits for coils and type, routine and individual tests. Copies of the specification may be obtained from the British Standards Institution, 28, Victoria Street, S.W.1, price 2s. (2s. 2d. post free).











Some Views of the Bradford Plant. **(See preceding pages)**

1. The Valley Road station. 2. The turbine room with the 30,000-kW l.p. set in foreground. 3. The h.p. turbo-alternator. 4. The No. 4 boiler house. 5. Front of the h.p. boiler at firing floor. 6. H.p. boiler feed pumps

Making Measuring Instruments

Recent extensions at a Lewisham factory

SO great has been the recent increase in the demand for electrical measuring instruments that Elliott Brothers (London), Ltd., have just opened at their Century Works, Lewisham, a new 20,000-sq. ft. extension intended exclusively for the manufacture of this type of apparatus. "Block Z," as the new building is called, is L-shaped and, as it now stands, represents approximately a half of the proposed final scheme, the removal of a temporary southern wall, allowing the extension of the building to almost twice its existing area.

As the shop is for purposes of small assembly, almost the entire floor area is covered by a light type of bench, altogether about seventy in number and averaging 28ft. long by 2½ ft. wide. These benches are fitted with Bunsen burners and electric heaters for soldering irons. Electricity for the latter is supplied from cables running in two long troughs in the floor, each bench being provided with a master switch which controls the whole of its heaters.

The latest extension to the Century Works of Elliott Brothers (London), Ltd., at Lewisham has a floor area of 20,000 sq. ft. used entirely for the production of electrical measuring instruments

Apart from the making of the magnets used, the factory may be said to be completely self-contained, and, although no conveyors are employed, production is practically continuous from the making of the various components in the machine shop, the coil winding and assembly to the calibration and testing.

In walking round the shops recently we were particularly impressed by the precautions taken at every stage to ensure the accuracy and reliability of the finished product. All scales, for example, are individually drawn on metal for each instrument, while one of the tests carried out on an improvised machine designed to discover mechanical faults seems almost too ruthless.

For the intricate work carried out good lighting is essential. The provision of a "north-light" roof and a large area of glass in the walls, together with the use of aluminium interior paintwork, solves the problem for the daytime, while at night 122 lamps (500 W) in Benjamin reflectors give an illumination of 30-35 ft.-candles (maximum over 40 ft.-candles) on the benches. The walls are kept free from cables, fuse boxes, &c., by concentrating the Erskine Heap circuit-breakers and Sanders ironclad switch and fuse gear in a gallery.

The building is warmed by a Sturtevant plenum heating installation. The fan and heating unit are mounted in a gallery in one corner and all the air ducts are run level with the eaves with suitable "downcomers" where required. The boiler house is large enough to accommodate a second boiler when the proposed further extensions are completed. The existing boiler is fitted with an automatic stoker, automatic feed pumps, &c.

The present extension, which gives work to about 300 employés (about one-quarter of the total engaged at the Century Works), is the biggest of several enlargements carried out during the past two or three years. In 1935 a cellulose-spraying shop was erected and later a floor was added over the shipping departments for the use of the sales department and typists. A large new Admiralty apparatus-testing shop was opened at the beginning of last year and includes among its equipment a device which approximately reproduces the rolling of a ship.

The expansion of the works has resulted not only in the improvement of products generally but in a considerable increase in the range of apparatus offered. To-day the company can supply instruments of all types, from "miniatures" of 2-in. dial diameter up to large power house instruments of 36-in. dial diameter, of all ranges and accuracies.

Hot Galvanising

CORROSION of iron and steel is responsible not only for incalculable loss of metal but also for corrosion fatigue, considerably reducing the endurance limit and leading to ultimate fracture. With ordinary iron and steel, corrosion is due to the combined influence of moisture, oxygen and carbon dioxide, the process being accelerated by acidic substances in the atmosphere and varying widely according to the circumstances.

On certain metals a film is formed naturally and protects it from further attack, as in the case of zinc in ordinary atmospheres. High-chromium iron and steel also provide their own protective coatings, but ordinary iron or steel cannot do so and becomes oxidised. The layer of oxide or other corrosive products being porous retains moisture, which takes up oxygen and acids from the atmosphere, thus still further accelerating corrosion.

As a preservative, paint has a limited life as it tends to crack, due to expansion and contraction of the coating under temperature variations. Hot galvanising, in which the metal undergoes a preliminary pickling in HCl to remove scale and is then immersed in molten zinc, gives an even and homogeneous coating that prevents the access of air and moisture to the basis metal. After a short exposure to the atmosphere the galvanised surface becomes coated with a dense and insoluble deposit of ZnO and basic carbonate which preserves the underlying zinc. The zinc coating (which is composite and consists of several layers that merge into one another) becomes alloyed with the surface of the iron and so there are no sharp boundaries between the two.

Steel members of the grid towers, galvanised before assembly, show no signs of corrosion after eight years' exposure to the weather. As some parts of the steel work are inaccessible, this has resulted in appreciable saving in maintenance costs.

Hot galvanising is distinct from the electro-galvanic method, in which the zinc coating is obtained by electro-deposition. This coating is comparatively thin and is generally employed for the protection of smaller articles, such as bolts, nuts and screws, where zinc might collect in the threads if galvanised by the hot process.

W. A. S.

The Characteristic Curve

By R. B. Rowson, A.M.I.E.E.

A neglected item of statistics and its implications

It is maintained that the average undertaking cannot afford to sell domestic electricity at less than 1d. per kWh

SOME years ago T. Norburg Schultz derived a connection between revenue per kWh and the number of kWh sold per annum per consumer from two basic relationships.* The more important of these relationships was one between the average revenue obtained each year per kW demanded and the average price per kWh received for such revenue during that year.

To this relationship he gave the name "characteristic curve of the undertaking" and stated that in the case of Oslo (of which undertaking he was the director) it could be represented by the equation:

$$E_h = 1{,}450\ 1_i^{4} \quad \ldots\ldots (1)$$

where E_h is the revenue in kroner per annum per kW of demand on the bus-bars, *i.e.*, revenue ÷ maximum demand, and 1_i is the average revenue per kWh sold expressed in kroner. At that time the pound sterling was worth about 18 kroner and at this rate of exchange the above equation can be rewritten in round figures as: $£ = 17^{4}d$. ..... (2) where £ is the revenue in pounds per kW per year and d is the average price per kWh sold during that year in pence.

The curve of this equation has been drawn in graph 1, and it will be noted that at an average price of 7d. per kWh the revenue per kW is about £55, falling to £17 at 1d. per kWh and finally passing through zero.

Theoretical Considerations

The fact that the curve passes through zero is important as it definitely fixes one point from first principles as apart from the remaining points which have to be obtained from statistics. The slope of the curve should also be noted, being greater as the price falls. By differentiating it will be found that the slope at 0.5d. per kWh is 13.5 compared with 6.6 at 3d. per kWh. Thus a small reduction in price from one that is already fairly low is likely to have considerable repercussions on the finances of the undertaking.

As revenue/kW ÷ revenue/kWh = kWh/kW, it is possible to obtain the number of kWh sold per kW at various prices per kWh by dividing the value of £ from equation (2) by the value of d. and multiplying by 240. Dividing this result by 8,760 gives the load factor in terms of units sold. Alternatively a new equation can be derived and is $L = .465/d^{4}$ .....(3) where L is the load factor expressed as a decimal and in terms of units sold. L is thus from 10 to 15 per cent. less than the more usual expression in terms of kWh generated or bought by the undertaking.

The curve of this equation has been drawn in graph 1 and though the load factor increases rapidly it is clear that the rate of increase is not sufficient to counterbalance the fall in the price per kWh.

Consequent upon the improvement of the load factor the cost of bulk supply per kW-year increases. The price of energy in bulk for a fairly large undertaking not having the benefit of selected station costs and being in the Midlands or the North of England may be taken as £3 per kW + 0.2d. per kWh at the metering point. Allowing a coal adjustment of 0.03d. and losses of 9 per cent. (rather low for domestic use) the rate per kWh sold is 0.25d. By transforming the original formula it can be shown that the cost of bulk supply per kW demanded is:

$$K = 17/d^{4} \times 0.25 + 3 \quad \ldots\ldots (4)$$

K varies in value from £4.95 at d = 7d. to £8.6 at d = 0.5d. Thus as the price per kWh sold falls the annual cost of bulk supply per kW-year increases whilst as shown above the revenue decreases.

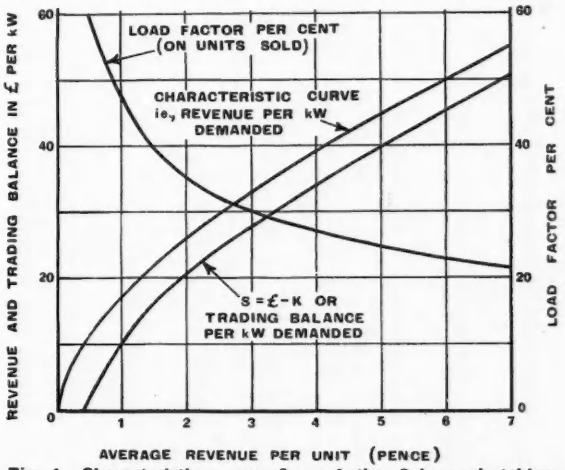


Fig. 1.—Characteristic curve, &c., of the Oslo undertaking (1930), based on bulk supply cost of £3 per kW plus 0.2d. per kWh plus losses, &c.

If the various values of K are subtracted from the corresponding values of £ we are left with a series of figures which represent the trading profit per kW of demand at different prices per kWh. These points are shown in graph 1 on curve S. This curve falls as the price per kWh sold decreases and cuts the x axis at about 0.4d. per kWh. Clearly, when this point is reached there is no balance to pay capital charges, management, &c. It will be seen, therefore, that the problem facing the industry is to determine how far the price, and thus the trading balance, can be reduced and at the same time leave sufficient to cover capital charges and working expenses.

Before proceeding with this problem it will be advantageous to compare the results obtained in Oslo with actual conditions in this country.

Statistics of English Undertakings

As it is easier and at the same time more accurate to compare graphs which follow straight lines the figures have been plotted on paper ruled in logs in both directions. Equation (2) may be rewritten as log £ = log 17 + .6 log d which if plotted in logs is a straight line and is shown in graph 2. This graph also shows the characteristic curves of several other undertakings. In each case the results for each year from 1921-22 to 1935-6 taken from the returns published by the Electricity Commissioners have been plotted and the various points joined together. The table below indicates the output and percentage of kWh sold for lighting and domestic purposes of the undertakings.

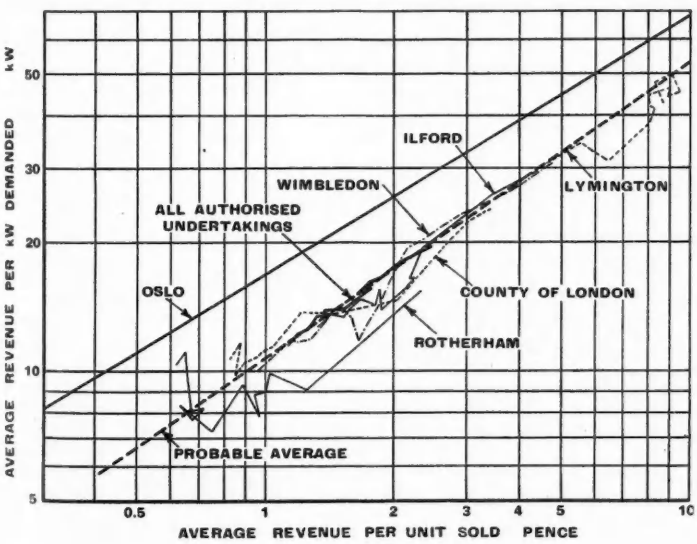


Fig. 2.—Characteristic curves of some British undertakings compared with that of Oslo

The undertakings vary from the very small to the very large, whilst the proportion of output sold for lighting and domestic purposes illustrates the different loads catered for. As at the present time domestic electrification is of major interest (for the main reason put forward for the proposed reorganisa-

* *Electrical World*, August 30th, 1930.

tion of the supply industry has been to benefit this class of consumer) two undertakings making a special feature of this type of load have been selected. For comparison Rotherham, which sells a high proportion of power, has also been included, and in order to substantiate the top part of the curve the characteristic of the Lymington Company has been shown. The first few years' results of the latter undertaking make an interesting study though it will be noted that in the end the general trend is followed.

Undertaking.	Output for 1935–36 (millions of kWh).	kWh sold for lighting and domestic use.
County of London Co.	885	18
Ilford Corporation	49	70
Lymington Co.	0.7	83
Rotherham Corporation	129	8.5
Wimbledon Corporation	60	77

The graph representing the results of all authorised undertakings has been based on the aggregate demand on the

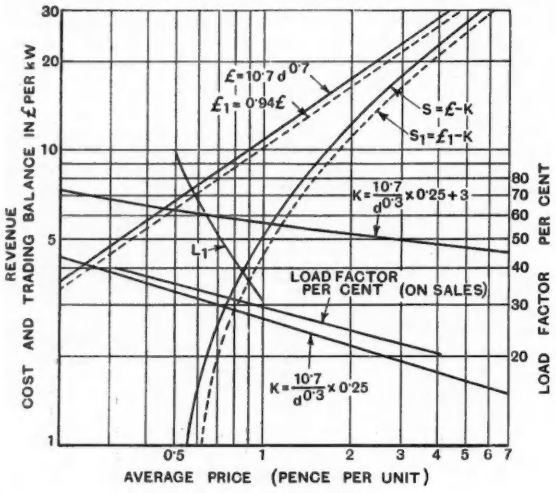


Fig. 3.—Trading balances

generating stations and tends to prove that the suggested average curve is reasonably correct.

The equation of the average curve shown in graph 2 is :—

$£=10.7 \cdot d.$ (approx.) ..... (5)

and, when compared with the characteristic of the Oslo undertaking, shows that conditions are such that in Great Britain the annual revenue per kW demanded and the load factor at any particular average price are not likely to be as high as in Oslo. This, of course, may be due to the exchange rates not being a true reflection of the conditions compared or possibly due to different climatic conditions which result in lighting having a better load factor. The form of tariff can also influence the results, and the "balanced beam" type of tariff which is popular in Scandinavian countries should definitely tend to encourage long hour use.

Application to English Conditions

If equation (5) is accepted as representative of conditions in this country then the equation for the load factor (based on sales) is :—

$L=0.295/d^{\cdot 3}$ ..... (6)

and the cost per kW year for the bulk supply

$K=10.7/d^{\cdot 3} \times 0.25+3$ ..... (7)

This equation and the graph of equation (5) have been drawn on graph 3 and are shown to cross at 0.46d. per kW.

As has been shown the trading balance in pounds per kW-year is :—$S=£-K$ ..... (8)

Calculated values of S are shown as curve S on graph 3. The values taken from this curve show the balance remaining to cover all capital charges on distribution, management expenses, rates, repairs and maintenance and income tax. The third item, rates, may together with the levy for change of frequency, be deducted as a percentage of the revenue. In view of the present tendency of the rating authorities, a figure of not less than 6 per cent. should be allowed for these two items. The line $£_1$ shows line £ (equation 5) after this deduction has been made whilst curve S_1 indicates the new balance available. This curve falls from £11.2 at 2d. per kWh to £4.4 at 1d. per kWh, *i.e.*, a fall of 60 per cent. for a reduction in average price of 50 per cent.

Cost of Distribution

The balance shown by curve S_1 has to meet all remaining expenses, a large part of which are in respect of distribution. For the year 1935-36 the Electricity Commissioners' return shows the capital expended on distribution and transmission by certain undertakings divided by their maximum loads. County of London Co., £37; Ilford, £38; Lymington Co., £119; Mid-Cheshire Co., £78; North-Eastern Co., £43; Rotherham, £22; Wimbledon, £38; all authorised undertakings, £45.

In addition to capital expended on transmission lines, mains services, etc., there is the expenditure in respect of meters, showrooms, tools, offices, etc., which for the country as a whole averages a further £7 per annum.

As the demand of most undertakings could be increased to some extent without entailing appreciable additional expenditure there is some justification for taking as an average, or rather representative figure, a value slightly below the national average, though as over 60 per cent. of the total sales in this country are for power and traction supplies the average figure may well be low already. That the cost per kW is rather lower for power supplies is confirmed by the Rotherham undertaking which selling about 90 per cent. of its output for power and traction has a capital expenditure per kW of about half the national average. For the purpose of the remainder of this article a figure of £40 has been taken for distribution capital and to this £7 has been added to cover the other items involved.

On the average, management, distribution, repairs and maintenance, etc., amount to just over 4 per cent. of the total capital expended excluding generation and apparatus on consumers' premises. Taking an average life of 25 years depreciation is another 2½ per cent. and interest, say, 4 per cent., making a total of 10 per cent. Thus the annual charges on £47 are £4.7 per annum. From graph 3 curve S, it will be noted that the surplus falls to this figure at just over 1d. per kWh, at which price the load factor (on sales) is 29.5 per cent. or, say, 32 to 34 per cent. on the usual basis.

Has the Limit Been Reached?

In the absence of any radical change in the price of bulk supply it would appear that on the average the price per kWh sold in this country is as low as it can be if insolvency is to be avoided. It also appears that tariffs for unrestricted supplies to small consumers which may result in lower average prices than about 1d. are unwise, for if they were taken advantage of completely the average price of the undertaking would be reduced below one penny, which would result in insolvency unless accompanied by a considerable improvement in load factor.*

This may be an unpopular conclusion, but it is difficult indeed to visualise how the position is to be improved to the extent necessary in order to sell at, say, 0.7d. per kWh for domestic purposes by any reorganisation of the industry, especially if such reorganisation is to retain the benefit of diversity to the C.E.B. Failing, therefore, the slight benefit which might have accrued had two or more undertakings been combined (*i.e.*, two undertakings each having a revenue of, say, £y per kW might have a combined figure of £1.1y) the only remaining avenues are to develop off-peak load and reduce distribution costs. Centralisation is hardly likely to benefit the former, whilst as may be shown from the McGowan Report distribution expense expressed as a percentage of capital remains almost constant irrespective of the size of the undertaking considered.

Whether the distribution capital itself can be used more efficiently and adapted to carry a considerably greater load without much alteration is a moot point and in any case the problem is entirely technical and thus unlikely to be solved by legislation.

The Water Heating and Cooking Loads

In conclusion it is of interest to touch briefly on two types of load, the desirability of which is the subject of much controversy, water heating and cooking. To compete, the former must be sold at not more than 0.5d. per kWh and for solvency a revenue of £15.9 p.a. per kW must be secured (taking distribution costs as £4 p.a.). As a reasonable consumption for a 1 kW heater is 3,000 kWh giving a revenue of £6.25 p.a. a diversity of at least 2½ must be secured. This is quite possible and indicates the desirability of securing the water heating business.

The cooker, however, is not quite so good. Taking an average consumption of 1,200 kWh giving revenues of £2.5 and £5 at .5d. and 1d. per kWh it may be shown that the demand on the bulk supply if all costs are to be paid must not exceed 0.16 kW and 0.49 kW respectively. Even the higher figure is less than the average demand per cooker given in the classic N.E.L.A. report, whilst the smaller, which is equivalent to an overall diversity of about 31, is, to say the least, most unlikely of attainment.

* The load factors required to maintain a balance of £4.7 p.a. per kW for distribution expenses at 1d. per kWh and under are shown as curve L_1 on graph 3.

Domestic Water Heating

By H. E. White

Practical aspects of installation

The author gives some useful data and formulae for calculating consumption, heat losses, etc.

FROM the showroom salesman's point of view, water heating inquiries are not all easy to deal with. He should first elicit from the customer sufficient information to enable him to decide whether a storage or immersion system should be recommended; whether hot water is needed at more than one point; the nature of the existing system and length of pipe runs, &c.

He can then simply, without confusing the customer with technical terms, explain the relative merits of each type of heater suitable for the actual requirements, and state their running costs and terms of hire or purchase. The necessary forms can be signed and the first payment or rental collected when the outside representative who will be responsible for the installation visits the house to inspect the layout of the existing system.

The majority of modern houses possess a hot-water system with storage tank or cylinder in the airing cupboard. To convert such an installation a hole is made with a cutting tool at the top of the cylinder and a screw-in flange inserted.

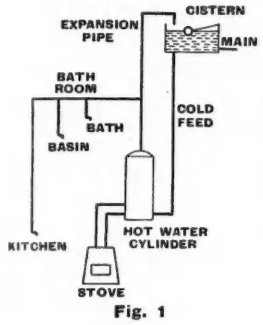


Fig. 1

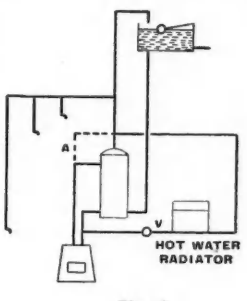


Fig. 2

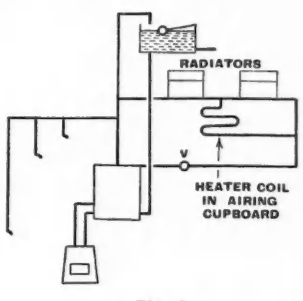


Fig. 3

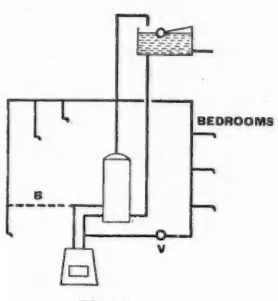


Fig. 4

This method is more convenient than the use of a sweating ring. A circulator type of immersion heater can then be screwed in vertically.

Where the consumer only requires hot water at certain times of the day, hand control by means of a single- or three-heat switch will suffice. In order that the heater should not be left switched on permanently, a control unit with a pilot or neon lamp should be fixed in a conspicuous position. The cylinder can then be lagged, but when single-heat control is used this is not essential.

With this system small quantities of hot water can be obtained, without the necessity of heating the whole of the water in the cylinder, at all hot-water taps in five minutes. With a 3-kW heater, sufficient water for a hot bath will be obtained in from one to one and a quarter hours, depending on the size of the bath required, at the cost of three to four kWh. This system is preferable only where the consumer does not mind switching on and off. The standby losses of the cylinder or tank, as the case may be, and pipe lines, are saved by switching off. It is not advisable to use a hand-controlled circulator in hard-water districts.

Automatic Circulators

A better method is to install an automatic circulator, fitted with a thermostat to maintain 160 deg. F. or other temperature, depending on the hardness of the water. Thus hot water is always available at all hot-water taps during the day and night. For economical operation it is essential to efficiently lag the cylinder or tank by covering it with an asbestos wool jacket strapped round. Other methods are lagging with some two inches of cork, slag wool, or magnesium compound. As many consumers insist on having additional heat at certain times in the airing cupboard, the jacket method has the advantage that any sections can be folded back, exposing a small area of the top of the tank or cylinder. The installation of a small tubular heater in the airing cupboard is another means of supplying additional heat.

An advantage of the thermostatically controlled circulator is that it may be used as an auxiliary to, or in conjunction with, the existing hot-water system. If the consumer does not require it at all times through the year, fires can be used in winter. The electric heater then supplies the hot water during the summer months, this having the advantage of maintaining a cool kitchen—also it can be left on when the fire is used, in order to "top up" the temperature overnight. The running cost depends entirely on the amount of hot water used. The average consumption for a family of four persons for all domestic purposes is usually from 60 to 100 kWh per week, with the heater working independently.

The installation of either system can be carried out in one day, complete with wiring, the water being turned off for approximately three hours only.

Radiation or standby losses depend on the size of the hot-water cylinder, the method of lagging, and the length of pipe runs. The saving effected by good lagging is from 80 to 90 per cent. The thermal conductivity of lagging material is expressed in B.th.u. per sq. ft. per hour per deg. F. per one in. thickness.

As an example, if the conductivity factor of the lagging material is known as well as the size of the cylinder, the radiation losses can be calculated as follows:—

Unit loss = conductivity × area in sq. ft. × deg. F. temp. diff/thickness (in.) × 3412.

The heat loss of one sq. ft. of galvanised cylinder is 215 B.th.u. per hour, with water temperature at 160 deg. F. and an ambient air temperature of 60 deg. F. Therefore, the loss per day per sq. foot of surface is 215×24=5,160 B.th.u. or 5,160/3,412=1.5 kWh. A 20-gal. cylinder has a surface area of 11 sq. ft., ignoring the base of the cylinder, which is cold. Thus the loss per day=1.5×11=16.6 kWh. In a year, the corresponding consumption would be 16.6×365=6,059 kWh, which at ¼d. per kWh would cost £12 12s. 5d. per annum.

If the same cylinder were lagged with a 1½-in. thick jacket having a conductivity of 0.237 B.th.u. per sq. ft. per hour per deg. F. for that thickness, then the annual loss would equal 0.237 × 11 × 100 × 8,760/3,412 = 670 kWh, which at ¼d. each = £1 7s. 11d.

By this means a saving of £11 4s. 6d. is effected. Pipe losses should be allowed for in addition to the above cylinder loss.

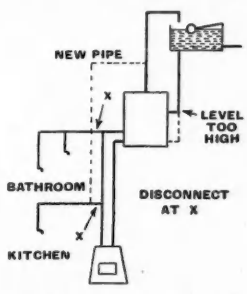


Fig. 5

When a consumer requires constant hot water, *i.e.*, conversion of the existing system with thermostat control, an immersion heater can be used instead of a circulator. This is fitted horizontally near the base of the tank or cylinder. There is practically no difference in radiation losses, while the amount of hot water available is slightly more with this type of heater due to the lower temperature variation.

Installation

As many existing installations are not straightforward, it is essential that the layout be inspected before fixing an electric heater, for circulation losses, unless checked, may cause the conversion to be a failure.

Fig. 1 represents a straightforward installation for providing hot water in the bathroom and kitchen; note the short pipe runs. Fig. 2 shows how a valve can be inserted at V in the secondary flow to make a straight draw-off system when the electric heater is being used; pipe AB (shown dotted) must

be removed. When the room radiator is in use the valve can be opened.

Fig. 3 illustrates the addition of two-room radiators and a heating coil in the airing cupboard, beside the usual bathroom and kitchen hot taps. A valve can be inserted at V when the system is to be used electrically, thus cutting out the radiators and the secondary flow. Fig. 4 depicts the addition of three hand basins in bedrooms on a secondary flow. A valve can be inserted at V and, as the hot cylinder is in the airing cupboard in the bathroom, there are two short pipes to the bathroom hand basin and bath and to the kitchen below. Hence pipe AB (shown dotted) must be removed.

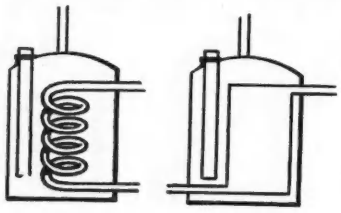


Fig. 6 (left) and fig. 7.

In fig. 5 the cold water inlet from the storage tank is too high up in the hot water tank. Thus cold water mixes with the hot. The bathroom and kitchen hot water feeds are taken from the flow return of the boiler. Hence a new ¾-in. pipe (shown dotted) should be run from the expansion pipe to the bathroom feed, and a ½-in. pipe taken on down to connect the kitchen, these two feeds being at the same time disconnected from the flow return pipe.

When inserting circulators in "calorifiers" or indirectly heated cylinders care must be taken to clear the inner jacket or coil. A special tapered flange can be used so that the heater is fitted vertically (figs. 6 and 7).

It is advisable to keep the pipe runs to the taps most frequently used as short as possible. Sometimes it is more economical to install a 1½-gallon storage heater over the kitchen sink if the pipe run to the hot water tap is a very long one. Always advise the consumer not to use an electric heater for feeding hot water radiators. For domestic hot water, the electric conversion is as economical as any other form in conjunction with the coke or coal-fired system. When a towel rail is in circuit it is advisable to shut the appliance off when not in use.

Automatic Storage Water Heaters

For a house which has no existing hot-water system, or where there are long pipe runs entailing excessive radiation losses, storage heaters should be installed. For a medium-size house a 1½-gallon non-pressure type should be used over the kitchen sink, and a 12- or 15-gal. non-pressure type in the bathroom.

In cases where two baths are required in succession the latter heater should be of 20-gal. size. Where a house has not the usual feed cistern tank, to comply with certain local water regulations, a cistern type of storage heater can be installed when the size exceeds 3 gal. capacity.

To fix the non-pressure type of water heater a tee piece can be inserted behind the cold water tap and copper or alloy tubing taken out of the tee through a patent fitting to the heater. This does away with the necessity for making a plumbing joint. If the normal plumbing system of a house is to be converted to electricity, a pressure type of heater should be used. This can take the place of, or be used in conjunction with, the existing hot-water cylinder incorporated in the system.

In a large house with many hand basins and two or three bathrooms with long pipe runs the best method is to split up the existing plumbing system into various sections. Then storage heaters of sizes appropriate to the outputs needed for each section can be fixed. Where the heaters are a long distance from the cold-feed cistern, cistern-type heaters should be used, doing away with the necessity for running long expansion pipes.

Regarding the standby losses of storage heaters, with the thermostat set at 165 deg. F., the approximate weekly consumptions are:—1½ gal (n.p. type) 5 kWh; 12 gal. (n.p. type) 12 kWh; 12 gal. (cistern type) 16 kWh. The cost of consumption at ½d. per kWh if all the water in the heater is used will be: 1½ gal. (n.p. type) ½ kWh=¼d.; 12 gal. (n.p. type) 4 kWh=2d.; 12 gal. (cistern type) 5 kWh=2½d.

Heating Formulæ

The following data are suitable for quick estimation:—Tank capacity (rectangular)=Height in.×width in.×depth in./276 gal. and (cylinder)=0.7854 (diameter in.)²×height in./276 gal. =(diameter in.)²×height in./352 gal. One gallon=276 cu. in. of water.

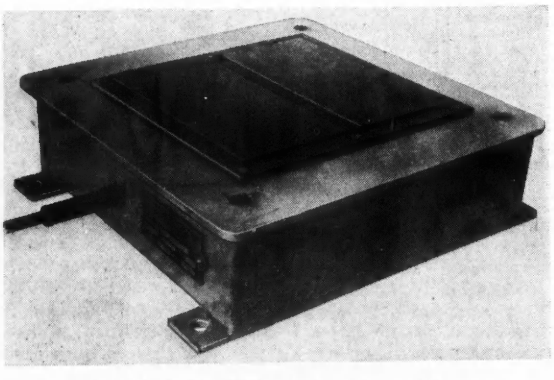
Loading, time and capacity in kW=gallons×10×temperature rise (deg. F.)/3,312×hours×efficiency=gallons×temperature rise (deg. F)/hours×300, assuming an efficiency of 80 per cent., although a more usual figure is 95 per cent.

From the foreging the necessary kW loading, kWh consumed, time in hours to heat the water, or the amount of water heated (in gallons) can be calculated, remembering that one kWh=3,412 B.th.u. and that one B.th.u. is the amount of heat required to raise one lb. of water 1 deg. F. For bath water the mean temperature=(gal. hot×temp. hot)+(gal. cold ×temp. cold) (total hot and cold gallons). A normal bath requires 12 gal. of water at 160 deg. F. mixed with 12 gal. of cold water, giving 24 gal. at 105 deg. F.=4 kWh per bath. The approximate cost of hot water used for domestic purposes is, for wash basins, from ¾ to 1 gal. at 160 deg. F. mixed with 1 gal. of cold water=one-third kWh per wash. For washing up, hot water between 120 and 150 deg. F.=one-third kWh per gallon.

Demagnetising and Demagnetisers. By H. E. Hutter

THE most prolific cause of residual magnetism in articles is the use of magnetic chucks. The high-intensity field, which is essential to obtain a strong grip on the work, results in the latter retaining a degree of magnetism (dependent on the hardness of the material) which is the cause of much trouble.

Tools made from hardened steel retain a higher degree of magnetisation than soft steel, and a hardened milling cutter, after taking a single cut through cast iron, has been rendered unfit for further immediate use. Many other machines cannot be worked unless all the components are absolutely demagnetised; small press tools would jam the work while machines handling small steel components would not be able to free them. The most convenient appliance for the removal of residual magnetism is the demagnetiser, which is made in a number of forms. Usually there are two flat steel platens underneath which are fixed two laminated magnets with exciting coils. The actual platens are mounted on insulating material to prevent eddy-current losses and heating. Demagnetisation is carried out by means of a rapidly reversing field which is conveniently obtained from an a.c. supply; even a 25-cycle supply will give efficient service.



A typical flat steel platen demagnetiser

A small article can often be completely demagnetised by being suspended on a cord and spun in a strong d.c. field from which it is gradually withdrawn. This method is unsuited to the treatment of numbers of parts for which properly designed appliances are required. Demagnetising can be done by unskilled labour; the work is passed across the platens and in the case of very thick work it can be turned over and passed over again.

The rigid specifications for Admiralty and Royal Air Force work often call for inspection by means of magnetic crack testing, which involves subjecting the work to an intense field. After testing the residual field must be removed from articles several feet long or thousands of parts such as turbine blades. This is best done by means of an a.c. solenoid, the articles for treatment being passed straight through the coil once.

The installation of a demagnetiser is simple, as there are no moving parts and the weight is sufficient to retain it in position without its being bolted down. It can be connected to the supply through a tumbler switch, there being no destructive arc such as is met with in d.c. magnets, so that the equipment can be readily moved about and plugged into a convenient socket.

Electrical Manufacturing in 1937

The B.E.A.M.A. report

THE report of the Council of the British Electrical and Allied Manufacturers' Association for the year ended September 30th, 1937, states that the past year marked a new high level of demand in the home market for electricity and electrical goods. Despite the strained international situation and formidable trade barriers, productive capacity in practically every branch of electrical manufacture was actively employed. The number of insured workers is now over 330,000, and since 1929 the electrical manufacturing and contracting industries have absorbed nearly 140,000 employés.

Exports have risen by 22 per cent. to over £18 million, the highest figure since 1929. The greatest advance in electrical machinery exports was in motors and switchgear. In other goods, exports of cables (other than rubber-insulated cables) advanced nearly 65 per cent. Purchases by foreign countries increased from £4,198,210 in 1936 to £4,802,596 in 1937. Nearly 74 per cent. of the total exports were consigned to Empire countries, compared with 72 per cent. in the previous year.

The ratio of electrical imports to electrical exports remains high, being now over 26 per cent. It is an anomalous situation that the United Kingdom, the second greatest electrical exporting nation of the world, should also be the second greatest electrical importer. The maintenance of a reasonable standard of living in the industry is rendered difficult by the influence of subsidised foreign competition.

Home and export trade was well up last year, employment increased and the apprenticeship position improved

Fluctuations in the prices of the raw materials of electrical manufacture were exceptionally violent, causing considerable uncertainty and higher production costs. While it may not be possible to eliminate raw-material price fluctuations, it should be feasible to obtain a more even flow of new orders than has been customary in the past. If this were done, the improvement in the load factor of the industry as a whole and its consequent more economical operation must result in a definite saving to the nation.

Electricity (Distribution) Bill

When it became known that the Ministry of Transport had under consideration a Bill based on the McGowan Committee's report the Director (Mr. V. Watlington) immediately called meetings of the chief representative manufacturing and contracting associations, and, after co-ordinating their views with those of the Council, represented to the Ministry the absolute national necessity of visualising the whole industry—supply, manufacture, contracting, and wholesaling—as working harmoniously together with the common object of providing better service to the public, and the danger, nationally speaking, of disturbing that harmony by revolutionary changes. Emphasis was laid on the danger of granting manufacturing powers to any new "compulsory amalgamation" of undertakings, and attention was drawn to the dislocation which would occur if the placing of orders was concentrated in the hands of a limited number of such amalgamations as against the existing conditions in which, owing to the large number of purchasers, business is divided fairly equitably between manufacturers.

If and when the Bill is presented the Council will be prepared to take all possible steps to ensure that the B.E.A.M.A. representations receive full consideration.

Trade Agreements

The only Empire trade agreement concluded in 1937 was that with Canada, to which reference was made in the last annual report. The agreement was subsequently ratified by the Finance Act, 1937, and came into effect on September 1st, 1937. It remains in force until August 20th, 1940.

Pending the making of new agreements with Australia, New Zealand, and India, to take the place of the Ottawa Agreements of 1932, the latter have been extended and are still in force. Negotiations for new agreements with all three above countries were initiated in 1936, and the views of the Council are before the Government. It is expected that the discussions with India and with Australia will be reopened during the present year. Preliminary discussions are also taking place between the home Government and the Government of the Union of South Africa. South Africa continues to be the leading purchaser of British electrical manufactures.

In view of the effect which the negotiations for an Anglo-U.S.A. trade agreement might have on the British electrical industry, the position was exhaustively examined by the Association, and a memorandum was submitted to the Government setting out the views of B.E.A.M.A. The electrical industries of the two countries are highly efficient and progressive, and both are engaged in supplying a large proportion of the world's demand for electrical products. Each is capable of supplying all its home market requirements, and it is obvious that little advantage would be secured by alterations in the present tariff position.

A memorandum setting out the views of B.E.A.M.A. on the National Defence Contribution was submitted to the Chancellor of the Exchequer, and the Council noted with satisfaction that the Finance Act, 1937, as finally passed, contained most of the modifications suggested in the memorandum.

Street Lighting

The Ministry of Transport issued a report on street lighting in September, 1937. B.E.A.M.A. and E.L.M.A. had, some time previously, submitted to the Ministry of Transport a memorandum on this subject, prepared by a joint committee, making a number of recommendations. The recommendations given in the Ministry's report are in accord with the suggestions made by the joint committee, and it is believed that the report will greatly assist further and more extensive street lighting on modern lines.

An Electric Illumination Exhibition was held at the Science Museum, South Kensington, from December, 1936, to May, 1937. It was organised by a committee of the Advisory Council comprising the leading electric lamp manufacturers, members of E.L.M.A., representatives of the N.P.L., and of the Electricity Commissioners. The exhibition was attended by more than 260,000 visitors.

Interference with Broadcasting

Continuous work has been proceeding throughout the year on the question of electrical interference with broadcasting. International meetings have been held under the auspices of the I.E.C. on the question of the permissible residual degree of interference and on the details of the testing set for the measurement of interference. The B.S.I. Committees dealing with this subject have also been fully active.

During the year B.S.S. No. 800 was issued, giving the limits of interference which must not be exceeded if the interfering appliance is to qualify for the mark, "Radio-Interference-Free." It applies particularly to small domestic appliances. Special specifications are being prepared dealing with electric lifts, neon and other electric signs, ignition systems and electro-medical appliances.

The limits laid down in the specification are such as can be secured by the application of condensers only, except in the case of certain portable appliances which require earthing where choke coils are necessitated. The best method of making and using such chokes has been actively investigated by the E.R.A. and the work is still proceeding. The work on trolley-buses and tramways is practically completed and the specification will be issued shortly.

The Science Museum Advisory Council appointed a committee (of which the deputy director and secretary was chairman) to draw up a report setting out present needs, both as regards space and the scope of the Museum, and this report was presented to the Board of Education.

The type of museum envisaged in the report would be a permanent exhibition of science and its industrial applications and uses. Electricity would have its own section, and electrical applications in other industries would also be shown.

The Revising Committee

The Conditions Committee of the I.E.E. has made satisfactory progress during the year in the revision of the text of "Model General Conditions 'A'—Home: with Erection." By the end of 1937 practically all points of difference between the various bodies interested had been resolved, and it is hoped that the new edition will be issued shortly.

With regard to "Conditions of Sale and Contract" (the "Brown Book"), the revision of the legal commentaries on the standard home and export texts was completed in the early part of this year, and those commentaries, made up as a separate booklet for each set of conditions, are being issued to members. When the revision of the whole book is completed it will be isued in "loose-leaf" form.

The Export Texts of B.E.A.M.A. Conditions have been revised, making them conform, where practicable, to the home

texts. A new text, "R.E.," for the repair of machinery or apparatus in use abroad, has also been issued.

In the opinion of Counsel, while members are adequately protected against damages for delay in delivery, if it is quite impossible for them to obtain supplies from their usual sources, they are not protected if those supplies could be obtained from other sources, even though the prices might be prohibitive. Consequently, those members manufacturing large plant have been instructed to include in letters accompanying their tenders a statement in a form approved by the Council which will protect them from liabilities for delay.

The Council has drawn up a contract-price adjustment clause which has been submitted to all Sections with a recommendation that it be used in any contract where the members were unanimously of opinion that losses might be incurred.

The Standardisation Committee has dealt with a wide variety of subjects sent up to it both by the technical committees of the Sections and by special committees for particular purposes. B.E.A.M.A. is now represented on over 226 B.S.I. committees and sub-committees, the number of representatives being 818. Reference is made to the I.E.C. and the Paris High-Tension Conference.

Information Service

The Statistical Department was in consultation during the year with the Government Committee responsible for the U.K. trade headings in the official classification, and four important alterations in the official list came into effect on January 1st, 1938, and a number of improvements are still under discussion. During the last ten years the number of official trade headings for goods produced by members of the Association has grown from fifty-three in 1928 to ninety-two in 1938.

The Department co-operated with other associations in the examination of the United Kingdom tariff position on goods in which members were interested. Discussions with the Import Duties Advisory Committee continued.

Many changes in tariffs and quotas in the Dominions and foreign countries were reported and notified to members. The Department was much occupied throughout the year in advising members in regard to existing tariffs, marking regulations, import restriction, &c., in foreign countries. Over 3,300 import licences for electrical machinery and apparatus exported to France were issued in 1937.

The I.M.E.A.-B.E.A.M.A. Joint Committee met regularly during the year and discussed many questions of common interest. The Committee considered a proposal that there should be a national electrical exhibition at Earls Court in 1938. It was found impossible to hold the exhibition this year, but the question of holding it in 1940 is now under consideration.

In the 1935 Report it was stated that the Joint Committee had instituted, through the E.R.A., a research into the question of transformer noise, and reports have been submitted which should prove useful in dealing with this difficult problem.

Representations were made to the Royal Mint on behalf of the meter makers and the Joint Committee regarding the new threepenny coin and certain alterations were made in the original design.

The Fair-Trading Code (which was issued by the Electrical Fair-Trading Council in 1936) continues to receive support.

Education and Apprenticeship

The Education Committee report that the number of overseas students employed in members' works during the year ended December 31st, 1937, was 217, India, as usual, sending the greatest number, followed, as in 1936, by South Africa, China, and Australia. Germany and the U.S. are newcomers.

The British Council has continued to develop its organisation for the training of overseas students from foreign countries as well as from the Dominions and Colonies. The Council has also extended its programme for training teachers of English who come from foreign schools.

The continued industrial prosperity of the country in general, and of the engineering trade in particular, resulted in greatly increased opportunities for young people leaving school to select for themselves the branch of work which they wished to enter.

The report refers to the activities of the Electrical Research Association, the Electrical Development Association, the Electric Vehicle Committee of Great Britain, and the World Power Conference.

Electrical Development Activities

Dr. Burgin commends E.D.A.'s work

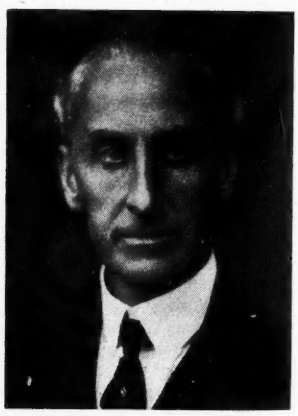
THE annual luncheon and annual general meeting of the British Electrical Development Association were held at the Savoy Hotel, London, on March 18th. As is customary the luncheon gathering included almost everybody of note in the electrical world. Alderman J. Chuter Ede, M.P. (President of the Association), was in the chair, and the principal guest was the Rt. Hon. E. Leslie Burgin, M.P. (Minister of Transport).

Dr. Burgin, proposing the toast of the Association, said that E.D.A. was founded in 1919 by a small band of visionaries, as all great world movements had been. In that connection he said he was glad to know that Mr. Cramb and Mr. Beauchamp were present. The visionaries who founded E.D.A. worked in a narrow field in 1919, but the membership was now 444, and the Association was really making the public electrically minded. A tribute was owing to the Association for what it had done on behalf of the nation for the improvement of industrial economy. There were a few instances—some rather notorious—in which there was hesitation at present in supporting the Association, but he felt they could look forward to an ever-increasing body of support from within the industry.

He was impressed with the expansion of the industry; between 1919 and 1937 there had been a revolution in the way in which the electricity supply industry had bitten into the field of industrial possibility, taking whatever "yardstick" they would to measure expansion, be it capital expenditure, revenue or number of consumers, or all three. In 1927 the capital expenditure of the electricity supply industry was of the order of £240,000,000, the revenue about £40,000,000, and the number of consumers 2,000,000. Ten years later the capital expenditure was £570,000,000, the revenue—not increasing in the same proportion, it was true—was £70,000,000, and the number of consumers was 8,500,000.

Referring to distribution he said that when it came to his turn, as Minister, to submit to Parliament measures for the improvement, as he hoped, of that side of the industry, the objective would be that the problem should be handled as a business problem, a mixture of technical and practical. Everybody concerned should be sensible enough to realise that unity was strength and that other things being equal the larger undertaking could afford more for research, for technical development and the pay of its technical officers than a number of small undertakings dispersed over a wide area. It was necessary also to keep prominently in view the fact that the test would be what the consumer thought and what the consumer received.

In conclusion, Dr. Burgin, after referring to the excellent work being done by Miss Haslett, Director of the Electrical Association for Women, in the domestic field, said that his appreciation of the work of E.D.A. and his message of goodwill was not to be measured by the shortness of his remarks but by the fervour with which he said that its welfare was his uppermost thought.



[*Elliott & Fry*

Lord Lytton, E.D.A.'s new president

The Chairman, responding to the toast, said it was clear that the growth of the British Electrical industry was such that the only people who could deal with the figures in detail and understand them were the National Debt Commissioners or the astronomers. Certain it was that the supply side of the industry had, during the past few years, brought to millions of housewives in various parts of the country relief from toil and grime which before the formation of the Association could not have been expected. He claimed this was a noble public service.

The Association had discovered that the best means of bringing to the notice of the housewife the advantages of the use of electricity was through Press advertising, and it sent every year 300,000,000 messages through the Press into the homes of the people making known to them the advantages of the very diverse forms in which electricity could be made use of for the improvement of the home and the lightening of the work there. It was possible in this way to make known the startling fact that only 2½ per cent. of the domestic consumers of electricity need pay more than 1d. per kWh and that over

60 per cent. could obtain electricity at a cost of less than ½d. per kWh. These were facts which really demonstrated the great benefits of such an Association as E.D.A. and fully justified its existence.

He sincerely hoped that the suppliers of electricity for domestic purposes would make friends with their local education authorities. There might be some people who still thought that electricity was a dangerous thing to have in the house, and if the electricity supply industry secured the interest of the education authorities it would be the best means of removing that hindrance to the expansion of the use of electricity for domestic purposes. That was why he was pleased to hear the Minister of Transport pay the tribute he did to Miss Haslett and her Association. He assured the Minister that the whole of the supply side of the industry, great and small, was concerned only with giving the best possible service to the consumer, and it was hoped to do better still when the results of the Minister's efforts fructified. He said "when" because he believed the time would come when they would fructify and enable the industry to give service to as large a proportion of the population of the country as possible.

Finally, Mr. Chuter Ede thanked the Minister for coming to the luncheon and for his good spirits at a time when every man and woman, who had any feeling for the future of civilisation and humanity, must trust that those on whom the fate of millions depended might be able, during the next few weeks, to view these great problems with the spirit of courage and cheerfulness and hopefulness which the Minister of Transport had applied to the more limited sphere which the activities of the electricity supply industry represented.

Annual General Meeting

Alderman J. Chuter Ede again presided at the annual general meeting, when Mr. A. E. McKenzie (Chairman of the Council), in presenting the accounts for the past year, said that the annual subscriptions amounted to £105,455 compared with £101,268 in the previous year. The amount spent on propaganda activities as a whole was £85,006, or 80 per cent. of the total expenditure as compared with 77 per cent. in the previous year. Among the various items of other expenditure reference was made to salesmanship training, for which enrolment fees amounting to £7,030 were received. The sum of £5,204 was paid over to the organisers of the cause, making, with the initial payment of £1,585 last year, a total of £6,770.

[*Lafayette*

Brig.-Gen. R. F. Legge, chairman of the E.D.A. Council for 1938-39

In a short discussion, a question was raised as to the contribution to the funds of the Association by the Central Electricity Board, and it was explained that the Board agreed to contribute £ per £ up to £50,000 per annum. Actually the subscriptions now exceeded £50,000 and the Board had been approached with a view to the extension of the arrangement to the larger amount, but Sir Archibald Page had stated that at the present moment it was quite impossible for this request to be acceded to.

The accounts were unanimously adopted, and Mr. McKenzie then presented the annual report of the Council, which is reviewed in the next column.

A suggestion was made that the Association should set up a research laboratory where the weak points of apparatus in competing industries could be ascertained and information given with regard to it for the benefit of salesmen who were frequently met with the story from the other side. If electrical salesmen could be placed in possession of definite data concerning the weak points of their opponents' apparatus it was contended they would be in a much better position to deal with questions which were often put to them. Mr. McKenzie considered that such a laboratory was quite unnecessary as all the information referred to could be obtained now on application to the head office of the Association. Also the establishment of the proposed laboratory would be quite impossible with the present funds of the Association.

Another suggestion made was that a National Exhibitions Committee should be formed which would divide the country into areas and arrange for exhibitions throughout these areas at definite times during the year. It was pointed out that at the present time manufacturers were opposed to local exhibitions in a large measure and that therefore if some such arrangement as mentioned above was adopted the manufacturers would come in. Mr. McKenzie said he was quite satisfied that there would be no support from manufacturers for such a scheme. In that case the total cost would fall on the Association and that was quite impossible with its present limited funds. The report of the Council was then adopted.

The President then reported the election of the Rt. Hon. the Earl of Lytton, K.G., P.C., G.C.S.I., G.C.I.E., as President of the Association for the coming year, and Mr. K. A. Scott-Moncrieff and Capt. C. E. Benson as vice-presidents. The Earl of Lytton then took the chair and said he would do his best to serve the interests of the Association during the coming year.

Responding to a vote of thanks, the retiring President, Alderman J. Chuter Ede, paid a high tribute to the assistance he had received during his year of office from the members of the Council, and especially from Mr. Cramb (the Director) and the whole of the staff, adding that the Association should regard the official staff with admiration and pride. A vote of thanks was also given to Mr. A. E. McKenzie, the retiring Chairman of the Council. After a vote of thanks had been accorded to the technical Press and to all who had assisted the Association during the year, the meeting concluded.

Annual Report

During the past year we have kept our readers informed of the many and varied activities of the British Electrical Development Association, and in our issue of January 28th (page 147) we printed a summary of the Association's work in 1937. These activities are reviewed at some length in the report which was presented at the annual meeting and we cannot do more than refer to some of the principal features.

There was a net increase of ten in the membership, raising the total to 444. The contributions from supply undertakings (including £50,000 from the Central Electricity Board) amounted to £105,456—an increase of £2,885. The total income was £105,884 and the expenditure £105,822. The principal items in the latter figure were: Advertising, £52,956; publications and technical services, £11,180; exhibitions, £8,616; Press writing and agents, £4,398; and contributions to other associations, £4,880.

Particular attention was devoted to refrigeration during the year, and the results were manifested in a large increase in the proportion of refrigerators supplied by electricity authorities. The Association's salesmanship training scheme was launched; about 1,000 candidates entered for the first examination, and it was anticipated that a further 400 would sit later this year. The Association's expenditure upon Press advertising exceeded by about 50 per cent. the sum which five years ago represented the entire income.

E.D.A. now claims to be one of the largest organisers of exhibitions in the world, and the section dealing with these is certainly impressive. A great deal of preliminary work has been done in connection with the organisation of an E.D.A. Electrical Pavilion at the Empire Exhibition, Glasgow, and support is being given by the Central Board, E.L.M.A., the Clyde Valley Electrical Power Co., the Scottish Power Co., and the Ayrshire Electricity Board. A fund of £6,500 has been raised, which will make it possible to erect a dignified and imposing electrical information centre. A display is being arranged at the Ideal Home Exhibition this year.

A useful development in 1937 was the launching of a series of specialist sales handbooks which, as a group, will form the basis of standard technical knowledge for sales staffs. The Association's specialist staff has been occupied to a greater extent than ever before in assisting members in general load-building policy and in negotiation with prospective users of electricity for heating and other large-scale purposes. Much of this new business is said to arise from direct inquiries from architects, builders and members of the public. Activities in this direction are classified under the headings of: Electricity in new houses, space heating, air conditioning, domestic cooking, commercial cooking, water heating, refrigeration, rural and agricultural electrification, industrial heating, street lighting, and electric traction.

The activities of the Area Committees, the Electric Vehicle Committee and the E.A.W. are dealt with in an appendix.

E.I.B.A. Luncheon

The annual luncheon of the Electrical Industries Benevolent Association will be held on April 8th at the Savoy Hotel, London, W.C.2, when the principal guest will be Dr. L. Burgin, Minister of Transport. Tickets (10s. each) can be obtained from the Secretary, 6, Southampton Street, W.C.1. The luncheon will be preceded by the annual general meeting of the Association.

The Fulham Power Station

Construction and operation surveyed in "Civils" paper

THE long two-part paper presented at the March 22nd meeting in London of the Institution of Civil Engineers described the construction of the first portion of the base-load generating station of the Fulham Borough Council on the north bank of the River Thames.

The first part, by Mr. J. F. Hay, dealt with the preliminary excavation of the site, the construction of the retaining walls and raft, condenser water system, coaling jetty and dredging operations. This part of the work cost £378,793, the author acting as resident engineer. The consultants were Messrs. Preece, Cardew & Rider, who appointed Sir Harley Dalrymple-Hay and Messrs. Mott, Hay & Anderson as joint civil engineers.

When complete, the station will require 14.5 million gal. of water per hour for cooling the condensers. The coarse and fine screens are of the Brackett vertical revolving band type, each driven by a separate motor and capable of delivering 2.4 million gal. per hr. The jetty is capable of berthing and off-loading two 2,000-ton sea-going colliers at a tide. Conveyors are installed between the jetty, the storage silo and the boiler-house bunkers. The authors point out the desirability of base-load stations being able to utilise coals of widely varying characteristics in order to keep down prices and avoid shortage of a particular class of fuel.

Steam Boilers

Mechanical and electrical features were described in the second part of the paper by Messrs. W. F. Parker and H. Clarke, Mr. A. J. Fuller being joint consultant. The first section of the plant was officially inaugurated eighteen months ago (see ELECTRICAL REVIEW, October 2nd, 1936) and when finally completed its capacity will be not less than 310,000 kW. It may thus become the largest municipally owned base-load generating station in the British Isles.

The eight boilers are of the Stirling tri-drum type with retort stoker, economiser and regenerative air heater, each capable of evaporating 260,000 lb. per hr. at an outlet pressure of 625 lb. per sq. in. and a final temperature of 850 deg. F. The retorts are 31 ft. 5.5 in. wide and 15 ft. long, being fitted rearward with large rotary toothed rolls for crushing the ash against adjustable aprons and discharging it into sluices below. Possibly the most interesting boiler feature is the design of the convection superheater, which, for steam temperature control purposes, has been divided into separate primary and secondary portions with a de-superheater interposed between them. To minimise the temperature differences they are so connected that steam from the left-hand primary flows to the right-hand secondary and *vice versa*. Regulation of the steam temperature is achieved by the simultaneous adjustment of two thermostatically controlled butterfly valves in the de-superheater and its by-pass circuit. Water fed from the boiler circuit cools the de-superheater, so converting the superheat into latent heat, the steam generated by this operation being returned to the steam space of the front drum of the boiler.

There are two induced-draught fans for each boiler, driven by two-speed motors. Because they follow immediately after the gas-washing plant, these fans are designed to be self-cleaning, with jets and sprays within their casings to wash solids off the runners. In practice, it is difficult to keep them completely clean and they are also subject both to erosion and corrosion. Experiments are proceeding with a view to overcoming this difficulty. Each boiler has two forced-draught fans and also two secondary air fans, practice having shown the last mentioned to be essential for the proper combustion of certain types of fuel, particularly Scottish coal.

Apart from the separate boiler-house control room, each boiler has its own panel. The operation of the boiler-house auxiliaries requires eight transformers of 950 kVA each, stepping down from 6,600 to 400 V. For driving the stokers at variable speed hydraulic transmission is employed; the stoker is actuated by a hydraulic motor served by a variable delivery pump driven at constant speed by a squirrel-cage motor.

Cleansing Flue-gases

The authors devote special attention to the methods employed for extracting dust and sulphur from the flue gases. The results obtained are claimed to be beyond dispute, since the actual sulphur content of the exit gas is generally as low as 0.006 grain per cu. ft. (the permitted figure being 0.03 grain) while only mere traces of dust of sizes less than 5 microns pass out to the atmosphere.

The two present reinforced concrete chimneys rise 300 ft. above ground level and their interiors are protected against chemical attack. An observation room is built on to the side of each shaft for gas-sampling and the accommodation of continuous sulphur recording apparatus. Also reheating chambers were provided at the base as a means of preventing the inversion of temperature

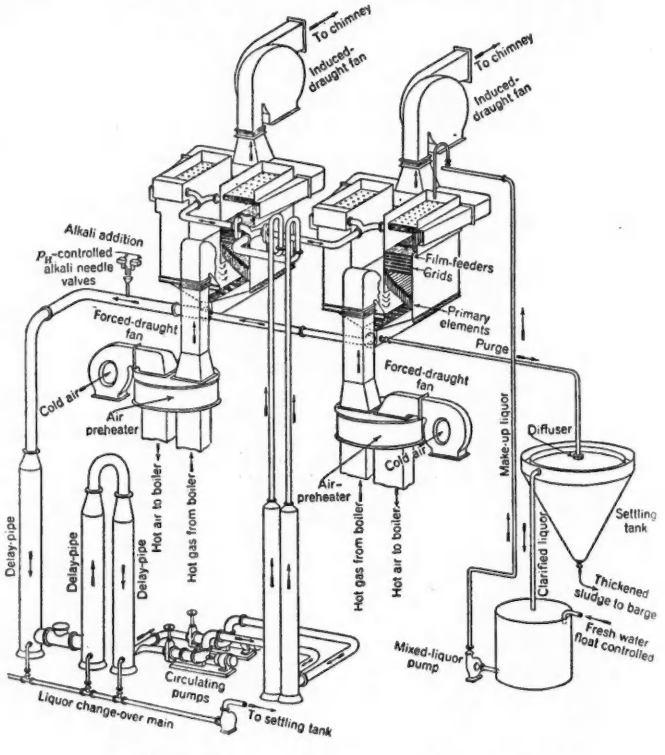


Diagram showing operation of the sulphur extraction plant

of the gases after leaving the washers, but they have not yet had to be used.

River water contains sufficient alkalis to remove sulphur from gases by washing. But sufficient water for this purpose could not be extracted from the Thames, so a non-effluent system was adopted on the principle of passing water containing lime and other forms of alkali in thin films at right angles to the gas flow. The sulphur dioxide in the flue gases is neutralised by the lime and precipitated as a mixture of calcium, the proportions of sulphite and sulphate depending upon the degree of oxidation.

Choking by crystallisation is avoided by maintaining a suspension of calcium sulphate crystals in the washing medium so as to desupersaturate the solution (aided by the addition of gypsum crystals) in portions of the plant specially designed for this purpose. In this connection Dr. R. Lessing did pioneer work.

For a single boiler the weight of liquor in circulation is 62 tons, the weight of ash and unburned carbon caught is 781 lb. per hr., and the solids formed 3,685 lb. per hr. The total solids in suspension with 5 per cent. gypsum in the circulating liquor are 13 per cent. The rate of circulation of washing liquor is 11,500 gal. per min., and the make-up water required is 32.7 gal. per min. The weight of one unit complete is 300 tons and the total cross-section of the washer is 400 sq. ft. The lime required is 1,100 lb. per hr.; 31,050 lb. of coal is fired per hr., of 10,900 B.th.u. per lb. and 1.7 per cent. sulphur content. From November 1st, 1936, to December 31st, 1937, 306,845 tons of coal was burned, representing 2,766 tons of sulphur.

Operation difficulties have been confined to maintenance. Silting in scrubbers is believed to be caused by unequal flow and distribution of liquor and gas; the material and design of the packings in the scrubbers are also being improved. As a protection against corrosion and erosion, rubber lining is employed, but the method of attaching it to metal is not entirely successful. Shrouding pump impellers or making them of

Meetings and Discussions

Ship Propulsion
Electrical Plastics
Power Rectifiers

The comparative merits of a.c. and d.c. for ship propulsion were mentioned in a paper on marine Diesels read before the Institution of Engineers and Shipbuilders in Scotland on Tuesday. The results of researches and a number of problems related to the production of plastic materials were presented in the paper read at last evening's meeting of the I.E.E. The discussion on power rectifiers at the previous meeting ranged largely around their use for traction purposes.

Marine Diesel Engines

MEDIUM- and high-speed Diesel engines for marine service are discussed in a paper by Mr. E. P. Paxman which was read before the INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND on March 22nd at Glasgow. The author points out that by making use of the "V" type of construction together with a low stroke/bore ratio it is relatively simple to design an engine which, while retaining all the robustness associated with lower speed, will produce its power continuously in a very much smaller compass and with parts that are very much easier to handle. The "V" engine saves enormously in weight and in every dimension, and lends itself much more favourably to coupling up to any form of electrical generator or similar drive and, further, due to the smaller cylinders, it is permissible to run both at higher speeds and with higher ratings.

Superchargers can be driven either directly from the engine or by an independent motor, and engines with sixteen cylinders, coupled to an alternator suitable for a.c. propulsion, owing to the extremely low cyclic variation and uniform torque, can be run at speeds from idling to their maximum without a flywheel, and so flywheels are not provided. Wellman-Bibby couplings of a special type are so arranged as to ensure freedom from torsional stresses throughout the required speed range and have the added merit of permitting axial movement of the engine relatively to the generator, and also of accommodating, to a certain degree, any misalignment that might arise in service due to movement of the seatings.

The 650-h.p. sets installed in the *Lochnevis* are, it is believed, the first fully isolated spring-mounted Diesel propelling sets of anything like that power and size. Each group of engine and generator weighs 30 tons, and the result of the spring isolation is to eliminate entirely any signs of transmitted vibration of the machinery to the hull. The higher the speed of rotation, the greater the number of cylinders, and thus the more even the torque, the easier does it become to isolate the engine. Also the small dimensions of the V-type engine permit it to be fitted with a sound-proof casing.

There are good reasons for preferring a.c. for the majority of normal electrical propulsion schemes, though it then becomes necessary for the engines to have a big range of speed control down to approximately one-third of full speed. This means that under all conditions other than maximum output and speed, the engines are running more easily and, of course, compared with the d.c. engine with a fixed speed, more efficiently. By grouping as many as four engines on to one motor it is possible to shut down one of the engines and thereby increase the load and economy of the remaining three under many service conditions.

The author has endeavoured to show that adequate means are available to-day not only to reduce wear and tear at high speeds and outputs, but also that when attention is required by the high-speed marine type, it can in fact be more readily and easily serviced than the larger lower-speed engines. At the same time, with the exception of a very few individual features, such as pistons and valves, cylinder liners, and possibly the crankshaft, only the normal materials used in the ordinary low-speed engines need be employed.

Plastics for Electrical Insulation

THOSE qualities of dielectrics which represent their value to the electrical engineer are discussed in the paper by Dr. L. Hartshorn and Messrs. N. J. L. Megson and E. Rushton (of the National Physical Laboratory) read in London on March 24th at a joint meeting of the INSTITUTION OF ELECTRICAL ENGINEERS and the Plastics Group of the SOCIETY OF CHEMICAL INDUSTRY.

The paper is based on investigations made at the N.P.L. and the Chemical Research Laboratory on behalf of the E.R.A. It points out that the plastics technologist does not primarily set out to serve the electrical industry. But some of his products are welcomed as insulating materials, and the authors' endeavour is to discover the essential nature of the processes that occur within existing plastic materials and whether their limitations are linked with chemical purity or their molecular structure, before attempting to indicate in which direction the search for better insulating substances would be profitable.

There is no single property of a material which can be taken as a criterion of its electrical performance under all conditions. For some purposes the permittivity and power factor are even more important than resistivity and breakdown voltage, quite apart from mechanical and thermal properties. The authors discuss the essential nature of plasticity and the chemical and physical relations that determine the attainment of this condition, which may arise in several ways; molecular formation is not the only factor controlling electrical properties, since macro-structure has an effect also.

The authors' experimental study of synthetic resins of the phenolic type and the heat-hardening variety (selected because it is one of the most widely used in the electrical industry) shows that the power factors of the hardened materials are probably characteristic of their molecular structure. When a rapidly alternating field is applied the polar groups will tend to vibrate, and it is suggested that the power loss in the material is associated with this vibration.

In ordinary atmospheres the resins take up from 3 to 5 per cent. of water, but it is not known how this moisture is held by the material, except that it is not by chemical forces. The water may collect in certain spaces in the resin structure either within the molecule or between molecular aggregates, and the power loss associated with it may be due to the motion of ions within these spaces.

The Fulham Power Station (*Concluded from preceding page*)

special chrome steel is beneficial. The elimination of brass from the washers reduced oxidation and immediately cut down corrosion to one-third its former value. Further success resulted from the introduction of an organic inhibitor (molasses) to prevent the calcium sulphite changing to sulphate. Introducing 25 parts per million of sodium silicate reduces corrosion by forming a protective skin on the metal; austenitic alloys offer considerable resistance and, in addition, contact between metals of differing potential, or areas of differing potential on a metal surface (in pumps), will aggravate corrosion of the anodic and protect the cathodic portions.

Electrical Plant Cost

In the turbine room the condenser water pipe-work is built into the basement raft. The three main generating sets are each of 60,000 kW (m.c.r.) at 1,500 r.p.m. They are of the two-cylinder type, the h.p. part comprising a velocity compounded stage followed by twenty-one single impulse stages, and the l.p. part incorporates thirteen impulse stages followed by a duplex multi-exhaust. The alternators generate at 11 kV and each is directly connected to a 75,000-kVA transformer stepping up to 66 kV on the station bus-bars.

House-service auxiliaries at present account for 8,000 kW, derived from one Ljungström turbo-alternator of 10,000 kW at 6,600 V; two 12,500-kVA transformers stepping down from 66 to 6.6 kV and fed from the station bus-bars; and three 750-kVA transformers reducing from 11 kV to 400 V and connected direct to the main generators. Each boiler is treated as a unit and provided with one 950-kVA transformer for stepping down from 6.6 kV to 400 V. All feed pumps are directly switched at 6.6 kV remotely (without local starters) and the initial kick on starting a h.v. pump motor is 7,000 kVA.

The main switching is performed at 66 kV with metal-clad gear. Each breaker is of 1.5 million kVA and weighs 19 tons with oil. Multiple switch houses provide physical separation for fire protection, which is fully explained in the paper.

For the present installed capacity of 190,000 kW the cost is £21.87 per kW. The steam generating and mechanical plant accounted for £7.08 per kW, the electrical equipment for £1.934, the gas-washing plant for £1.521, four sea-going colliers for £0.791, housing transmission switchgear for £0.295 and air-raid precaution measures for £0.263. A normal station of similar size would cost £19 per kW installed.

The paper concludes with station performance figures, which indicate a total works cost of 0.139698d. and a coal consumption of 1.0137 lb. per kWh generated, the average overall thermal efficiency being 26.256 per cent. for the month of January, 1938.

Turning to new developments, the authors explain that plastics are essentially materials of which the molecules are relatively large complex structures, each molecule being built up from units of one particular kind, the size of the molecule depending on the number of units. The properties of plastics will depend largely on the properties of the unit from which their molecules are built up, and the comparatively high power-factor of the phenolic resins has been attributed to the presence of a polar group in the unit. This suggests that if a structure could be made similar but containing no polar groups, it would possess electrical properties superior to those of the phenolic resins. The most obvious change to make is to form hydrocarbon resins, several of which have been made, and their electrical properties are outstandingly good.

For example, polystyrene and polyindene have been made in the form of clear glass-like solids. The outstanding characteristic of these materials is their low dielectric-constant (about 2.5) and a power-factor as low as 0.0002, and it follows that these materials are almost ideal for work in which the minimum power-dissipation is of the first importance. Examples are cables for very high frequencies, *e.g.*, for television, moulded components for ultra-short-wave radio work, and junctions for high-voltage cables. These two materials are apparently not yet being produced in this country. Polyethylene has, however, recently been produced and it should have electrical properties similar to those of polystyrene and polyindene.

No existing material satisfies all electrical requirements. It has been found possible to introduce a certain amount of cross-linking between the chain molecules of polystyrene by the addition of a small propertion of *p*-divinyl benzene before polymerisation. Thus the cross-linked structure is possible in hydrocarbons, but the mechanical strength so far achieved is not equal to that of the polar materials.

Thus, if on the other hand, polar forces are essential for mechanical strength, how can one control the freedom of movement of the polar groups, so as to avoid excessive energy-dissipation in the material? The authors' experiments suggest that this may be done by the addition of other large groups to the structure, but such questions can only be answered by further research.

Mercury Rectifiers

RECENT progress in mercury-arc power rectifiers and their applications, as outlined in the paper by Dr. W. G. Thompson to which reference was made last week, was discussed at the INSTITUTION OF ELECTRICAL ENGINEERS in London on March 17th.

Mr. C. E. Fairburn commenced by remarking that at first sight the non-vacuum type of rectifier might arrive too late. He also considered that for some cases the rotary convertor was not yet obsolete. He had some three dozen glass-bulb sub-stations in use for supplying d.c. to hotels, docks, cranes, &c., and generally they had all been satisfactory. The type of glass required for them was now much better understood. The use of glass-bulb rectifiers on the Southport and Wirral electrified railways showed what confidence the L.M.S. Railway Co. placed in them. Some of the steel-tank rectifiers used for railway traction had not been so reliable as glass bulbs. There was an urgent need for a standard specification which should outline the general requirements without going into great detail. Such a specification was now being prepared and its issue could be expected before long.

The addition of "gadgets," he said, tended to reduce reliability and increase maintenance. He had yet to be persuaded that grid control was really necessary for traction purposes, though it might be justified for arc suppression. No sufficiently good reason had yet been given for the declaration that mercury rectifiers demanded a.c. switchgear with larger ratings than usual. If that were really true, it might revive the use of rotary convertors. If the pumpless type had arrived at the same time as the glass bulb the latter might not have remained in use, though it was not any longer regarded as fragile. Methods of frequency control were interesting, but involved the use of valves for auxiliary control.

Dr. C. C. Garrard said that the paper would cheer the hearts of older men who had been brought up on d.c. and still clung to their old love. The rectifier had ousted all competitors, but they must be careful not to expect too much of it. Careful technical and financial analysis had shown that d.c. transmission could not compete with a.c., however high the voltage might be. There was no need to retain some rotaries in rectifying installations because the latter functioned entirely satisfactorily even with regenerated motors on railway traction systems. This paper had "debunked" grid control and it would be well to pause before they spoiled the simplicity of rectifiers by adding grid control solely in order to deal with regenerative control on railways.

Odd harmonics on the primary side would not affect communication systems if cables were used for distribution, although they might do so if overhead lines were employed. He did not believe that rectifiers demanded a.c. circuit-breakers of greater capacity. That idea had probably arisen because circuit-breakers were not tested in the past. To-day one knew exactly what they were capable of doing and there should be no further trouble of this sort. The use of twelve-phase transformers did produce more even d.c., but did not avoid the need for smoothing gear. If one gained anything at all it was not enough to compensate for the added complication.

Electrolytic Work

Mr. E. Gallizia had only one criticism to offer, which was that the paper did not make sufficient reference to rectifiers for electrolytic work. The chief trouble with the Marx type had been electrode wear, but that type was the only practical solution in the case of high voltage up to 300 kV. There was room for all three types, meaning glass bulb, steel tank and pumpless. The last was heavier than the glass bulb, but the light emitted by the latter could in some cases become a nuisance. He supported the need for a standard specification and pointed out that the production of harmonics depended mainly on the choice of number of phases and the rectifier designer had little to do with that.

Mr. T. S. Pick said that the remedy for corrosion in water jackets was exclusion of oxygen and not the addition of chemicals to the water. He was disappointed that the Marx type was no nearer to the commercial stage as it appeared to be the only truly reversible type. The fact that resonance could be caused on the a.c. side was disturbing, since this problem was very much wrapped up with inverted operation. Possibly by designing the rectifier in two halves some cancelling out might be achieved, and phase shifting could be employed to maintain the power factor.

Mr. J. C. Read said that grid control of the rectifiers on the South African railways was of a somewhat pioneering nature. It was the first installation used for absorbing power on a wholesale scale, larger than had before been attempted. The transmission lines were long and subject to lightning surges, while the provision of flat compounding had special aspects. After eighteen months' operation it was possible to say that they had functioned quite satisfactorily in full service.

Advantages of Glass Bulbs

Mr. A. M. Brown agreed that multi-banks of pumpless rectifiers would minimise arc drop and so increase efficiency. The proper way to increase anode area was to incease their number and not their size. This did not mean any sacrifice of space. Glass bulbs could be banked in two tiers to save space, making them comparable with steel tanks. The field of usefulness for water-cooled rectifiers would soon be limited to large sizes for electro-chemical purposes, where spacing did not matter; but they needed more auxiliaries. Glass bulbs could be made much larger than they were at present, but better efficiency and reliability could be obtained by paralleling smaller units. The weakest link in the chain was the seal; the vitreous enamel seal did not do anything that a glass seal could not do. There were no difficulties in making or operating twelve-phase installations and during manufacture glass bulbs were subjected to very much higher temperatures than those encountered in operation. They had also successfully withstood gun-fire shock.

Mr. G. Henderson objected to units in parallel because he desired to reduce auxiliaries, since they gave more trouble than the rectifiers themselves. There were many 2,500-A sets in use for traction purposes and many 8,000-A sets for electrolytic uses. A rectifier could not be described as truly pumpless if it would not maintain its vacuum for several years. The loss of vacuum was not due to the seals. Continental designers had done far more for grid control than we had in this country. When properly designed, grid control permitted an increased capacity and did not involve derating as suggested by the author. One of its most important applications was to arc suppression.

Mr. H. C. Harris asked if the pumpless type really necessitated the use of special alloy steels and greater tank thicknesses. Was it necessary to place the grain of the steel at right angles to the atmospheric pressure?

Mr. J. North objected to double tiering because it would make the equipment too high. A similar output could be obtained from fewer units of larger capacity, which would take up less room than pumpless steel tanks.

The author, in reply, said that there were still many factors to be solved before d.c. transmission became effective. It was quite possible to employ one pumpless rectifier in a sub-station to deal with the small amount of reverse current. One year's service on the South African railways might possibly be the equivalent of one week's service on the London Underground railways. He had omitted reference to large rectifiers for electrolytic work because they were all used so far away from this country that one could not obtain direct information about their operation.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

The E.D.A. Salesmanship Course

I, too, was interested to read your editorial comments quite recently on the above matter. The remarks of Mr. R. H. Cox in your issue of March 11th, however, are quite beside the point, I think. I am prepared to admit the usefulness and necessity of such a course for the training of future sales staffs in the industry, but certainly not for the purpose of training sales engineers in the 30's and upwards, which is the point I am attempting to make and which I believe was intended by the Editors. Agreement or disagreement as to the advantage of such training is not the issue, nor is it a matter of sacrificing prestige or suffering the humility of studying salesmanship along with junior staff.

If a salesman at the age of 25 or 26 years doesn't know the conduct and the essential information as contained in the six handbooks after some five or six years' experience in an electricity supply undertaking, he is hardly worthy of the designation "salesman." If when in the 30's he has not acquired the most reliable experience of all in the hardest school of all, "life experience," "trial and error," call it what you will, he will never be worth his salt as an apostle of electrical service and E.D.A. sales courses, and any amount of training will not achieve the desired result. On the contrary, why also attempt to "Edafy" the already proved successful sales engineer if it possibly means disproving, at the expense of a sales course and a subsequent written examination, that he is not the success his colleagues on his staff—perhaps juniors—have always regarded him to be, by example and results?

When one reaches middle age, life itself is getting too short to argue the case even for electricity as aggressively as some sales methods would have us do, and after all isn't physical fitness and abounding enthusiasm quite as important for success as anything else, not forgetting that an ounce of practice is worth a ton of theory. A. V. CROSS.

Reading, *March 15th.*

Change-over Questions

I should be grateful for the opinion of your readers on the following point.

A client of mine has for some years been taking a d.c. supply from the local undertaking on the off-peak system, as this was offered at a greatly reduced figure as compared with the all-day supply. This necessitated his installing a stand-by plant for use after 4 p.m. when the clock switch cuts him off during the months October to March. The undertaking has now given notice that it is changing from d.c. to a.c. and will be taking the bulk of its current from the grid. It agrees to be responsible for rewiring and the exchange of all motors but not for the conversion of the stand-by plant, maintaining that this is not its responsibility as an all-day supply is available. This is quite true, but there is a great difference in the prices of the all-day and off-peak supplies.

Can the supply authority be compelled to give a full-time supply at off-peak price or made responsible for the conversion of the stand-by plant which will possibly cost £1,000?

March 15th. FAIRPLAY.

Overhead Line Construction

Regarding Mr. McCombe's interesting article in your issue of March 11th, would the author please explain the following points:—(1) How can stays and insulator prices be specified without regard to conductor size? (2) Would it not be practicable to use one size of stay wire throughout and increase the number in proportion to the strain? (3) Is it absolutely necessary to displace corner shackle poles by 2 ft. 3 in. when the standard pole can deal with 2 deg. angles? (4) Why is this form of construction only applicable to 35 kV and how can conductor spacing be defined without relation to span length? J. W.

Kenilworth, *March 15th.*

Concrete Poles in Rural Areas

In his article on page 349 of the ELECTRICAL REVIEW of March 11th, Dr. J. McCombe makes the following statement: "At the present moment all electrical firms are suffering from bad deliveries of all types of poles and steelwork."

As suppliers of creosoted wooden poles for the past sixty years, we must take exception to this sweeping assertion. We have large stocks of all lengths of poles from 18 ft. to 70 ft., and can give delivery in three to four days from receipt of order. As Mr. McCombe's article will, no doubt, be widely read, we trust you will give equal prominence to this letter. ARMSTRONG, ADDISON & CO.

Sunderland, *March 17th.*

I have noticed an article on the above subject in your issue of March 11th. I would like to point out that there should be little difficulty in finding suitable wooden poles and that the delivery of bad poles is hardly a fair accusation. The Post Office Stores Department has a very rigid specification for wooden telegraph poles and these can be quite well supplied to them when they are required. E. H. B. BOULTON.

Technical Director, Timber Development Assn., Ltd.

London, E.C.4, *March 21st.*

Applying for an Appointment

I have read with some interest the correspondence following the interesting article by "Chief Electrical Engineer," on the subject of applying for a position. I see in your issue of February 25th a letter from a man, who signs himself "Cos ϕ." Speaking as one who is responsible for the employment of a considerable number of men, I think that your correspondent's attitude of mind is his own undoing. Many men who are responsible for engaging technical assistants avoid applications from friends and relations, and refuse to consider them if other suitable men are available.

It may interest the rising generation to know that during the last twenty-six years I have worked for four companies, and in every case I was engaged in the open market entirely on my own merits, and as a total stranger.

Canada, *March 11th.* ANOTHER CHIEF ENGINEER.

I.E.E. Membership Regulations

I fully endorse the remarks made on the above subject by "A Graduate" in your issue of March 18th. He makes the statement that a graduate may spend his whole career in a post which never brings him sufficiently in touch with members to enable them to sign his form from personal knowledge.

In my own case I am in personal touch with one member and one associate member and am not likely, if I remain in my present position, to be personally known by the requisite number of corporate members. To visit my local sub-centre necessitates a journey of over forty miles and the members there present are not likely to become well acquainted with me unless I go to considerable expense in travel.

There is no doubt that to be a corporate member is necessary for real progress and the Institution is to be praised for the universally recognised status of its corporate members, but the difficulties experienced by some graduate members in reaching that desired state is greater than those they have to overcome in acquiring the necessary technical knowledge and experience to enable them to qualify for it.

Your correspondent states that the Council is unlikely to pay any heed to his small voice, but I willingly join mine to it and hope that others will do the same so that the Council will eventually realise that there is need for reform in this matter. ANOTHER GRADUATE.

March 18th.

So "A Graduate" is still grousing? Probably not the same graduate as the one who groused ten years ago, and the grouse itself has changed. Then, "A Graduate" objected to being mixed up with older men, without State-aided technical education, but often with far more ability to shoulder responsibility.

So he egged on a well-meaning Council to press such men either to pass examinations or get out. Once these obstructions were removed, the graduates would have a clear road before them to associate membership. Like many men who were busy at that time, I could not spare time for examination cramming, but just "got out," without grousing.

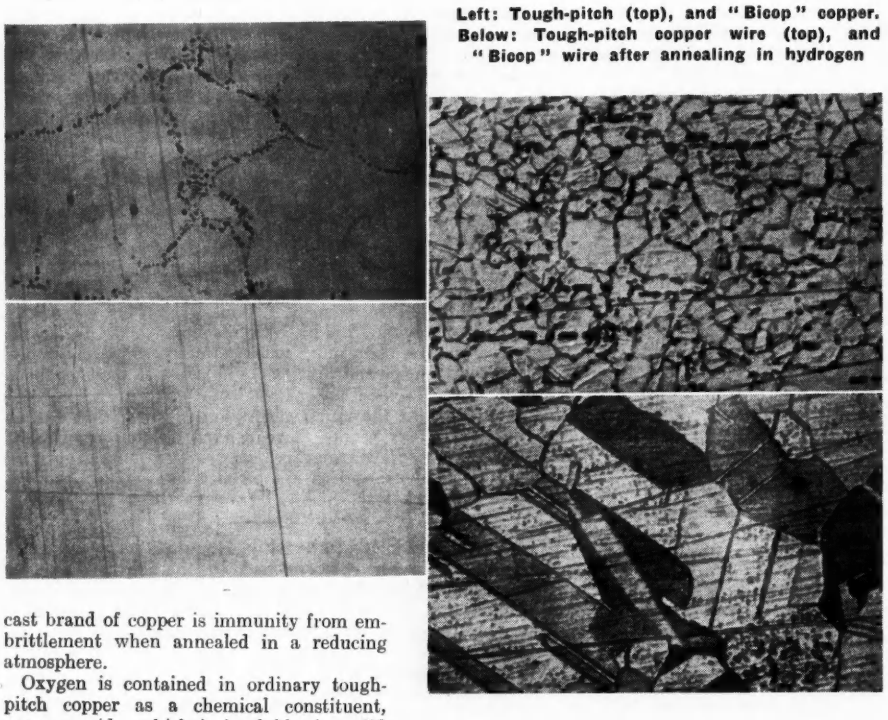
March 18th. EX-GRADUATE I.E.E.

I think that "Graduate" is wrong in suggesting that the signatures necessary on proposal forms for associate membership should be waived; rather they should be limited to one member and two associate members. It is undesirable that the details on the form should be submitted to the Institution without any checking and initialling by the sponsors. I realise that the signatories have not personal knowledge of all the facts stated in the form, but some at least they can vouch for. If they have any doubts as to the accuracy of the remainder they would, doubtless, hesitate to initial them without inquiry of the applicant.

Also, he suggests that candidates should be provisionally admitted to associate membership. Surely, if a graduate's qualifications warrant this for a limited period, they warrant

Oxygen-free Copper

A HIGH-CONDUCTIVITY copper substantially devoid of oxygen has been evolved for use where ductility, toughness resistance to fatigue and high density are particularly needed. It is also specially suitable for welding. An outstanding advantage claimed for this "Bicop" vertically-cast brand of copper is immunity from embrittlement when annealed in a reducing atmosphere.



Left: Tough-pitch (top), and "Bicop" copper. Below: Tough-pitch copper wire (top), and "Bicop" wire after annealing in hydrogen

Oxygen is contained in ordinary tough-pitch copper as a chemical constituent, cuprous oxide, which is insoluble in solid copper and is found in the crystal boundaries of the metal but not evenly distributed throughout the mass. The corrugated copper surface of the wirebar known as the "set surface" is composed almost entirely of oxygen-rich copper (0.39 per cent.), the oxygen content gradually diminishing downwards to a depth of 0.5 in. (or occasionally even 1.0 in.) when its value is found discovered to be stable at from 0.035 to 0.045 per cent.

Photomicrographs of "Bicop" indicate an absence of cuprous oxide that contrasts favourably with the intercrystalline inclusions which occur in the standard horizontally-cast tough-pitch type.

Similar photographs of metals of both kinds after being annealed in hydrogen for 120 m. at 850 deg. C. show the former to be still sound, whereas the reduction of the CuO_2 in the latter has partly removed it from the crystal boundaries causing sponginess.

Torsion tests (twists in 6 in.) made on 0.081-in. diameter wires gave representative values for hard-drawn, bright-annealed and H_2-annealed (30 min. at 850 deg. C.), "Bicop" of 122, 138 and 134, and for tough-pitch copper of 38, 85 and 9. Similar values from bend tests were 48, 73 and 95 on the one hand and 18, 45 and 3 on the other. Tensile strength is approximately the same for both kinds of copper, being about 31 for the hard and 16.6 for the commercially bright annealed, and electrical conductivity is also similar, the values obtained meeting all standard specifications. After annealing in H_2 for 30 min. the ductility of "Bicop" was such that it could be tied into a tight knot without damage.

The reduction in area of a tensile fracture in hard drawn wire amounted to 80 per cent. for "Bicop" and 40 per cent. for the tough-pitch copper sample. Fatigue tests on the Haigh-Robertson machine and twisting tests showed further advantages of the new copper, which is available in all sizes and shapes of wire in strips, sheets and special sections. "Bicop" copper is a product of the B.I. Cables research laboratory.

In the accompanying illustrations the left-hand photomicrographs (mag. 150) are of specimens cut from a horizontally cast tough-pitch copper wirebar (taken from the area where the oxygen content is stable at approximately 0·04 per cent.) and from a "Bicop" wirebar, the specimens being shown in the polished but unetched state. The right-hand photomicrographs show the effect of annealing in hydrogen for 2 hr. at 850 deg. C. on wires produced from the two types of metal.

Correspondence *(Concluded from preceding page)*

it for an unlimited period. One age limit for entry should be fixed, as under the present by-laws a graduate who has not had college training or a works apprenticeship has to be four years older than the graduate who has had these advantages. Now, there must be a large number of graduates who have had neither of the above, but have been in industry since leaving school. They have worked for their technical qualifications in the evenings.

In my own mind, there is little doubt as to who has put most work into the attainment of his qualifications. It is no easy task to pursue a course of study (for five to six years) in the evenings after working all day in factory or office. I feel there is one great advantage in this method as, whilst theoretical knowledge is gained in the evening, practical experience is gained in industry during the day.

I suggest that after obtaining the technical requirements for graduate membership a course of study should be taken in, say, workshop organisation, engineering economics, or some other kindred subject. Graduates should, on passing in the selected subject, be then admitted to associate membership, providing that the age of the candidate is above the decided age of entry and that he holds a technical position.

I must agree with "Graduate" that although *we* know that the technical qualifications are equal to those of an associate member, apparently nobody else does. Only a short time ago I knew of a post offered for which a graduate was required at a salary of £3 per week. This offer proves that employers do not hold graduateship in very high regard. I must also agree that, even nowadays, apparently, class distinction still matters a great deal.

The present position can best be described as a vicious circle. One cannot obtain associate membership until one has secured and held a responsible position, and one cannot secure a responsible position until one has obtained associate membership. An absurd position, to say the least.

March 22nd. A GRADUATE ALSO.

I heartily agree with your correspondent's remarks regarding the status of graduates of the I.E.E. This distinction seems to stand for very little when applying for jobs, and it is time that employers realised that graduates have had to pass an examination of high standing.

Graduates should insist that more publicity be given to ensure that this qualification and what it stands for get the appreciation and respect they deserve. In my experience many employers do not understand what the letters Grad. I.E.E. represent, how then can they be expected to realise that the passing of the examination is a definite qualification?

I have been a graduate now for some years and although I have what may be considered a fairly responsible position, not having either the time or money to cultivate the necessary social contacts, I am not much nearer the A.M.I.E.E. There must be hundreds in the same position.

The older graduates pay the full subscription and have passed the same examination as associate members and they should be accorded a better status. Graduates should insist upon recognition, and corporate members should insist that only graduates shall be eligible for certain jobs. It seems a waste of money paying subscriptions for something that apparently carries very little weight even, it is to be feared with corporate members themselves. ANOTHER GRADUATE.

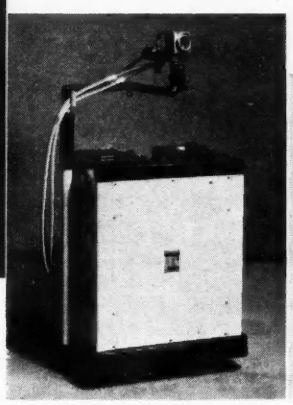
March 21st.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Electro-medical Equipment

At this year's British Industries Fair were exhibited several improved lamps for electro-medical use, of the "Sollux IV" "Kromayer" and "Centrosol" types, and a ward model actinotherapy lamp, all made by HANOVIA, LTD., Bath Road, Cippenham, Slough.



Left to right: The Hanovia "Centrosol," "Kromayer IV" and "Sollux V" with a 1,000-W luminous heater

The last mentioned is mounted specially for treatment in hospital wards. The light source is a mercury arc within a U-shaped tube of pure fused transparent quartz (Type S, 250U) and the position of the reflector enables either general or focal irradiation to be given. An extension arm pivoted at two points gives rigid support to the actinic source at any distance up to 26 in. for the upright, enabling the lamp to be brought over the patient's bed. The upright is telescopic and self-locking, giving 22 in. vertical travel. The trolley carries the electrical control equipment and the localising plate, the large dial timer being fixed to the trolley-side.

For focal actinotherapy the latest "Kromayer IV" lamp has been provided with an automatic self-contained water circulator so that the arc is enabled to operate at 6,000 deg. K. only 30 mm. from the treatment window. When in contact with the skin erythema can be produced in 10 sec., although where severe reactions are required exposures as long as 15 min. may be made.

In the control board on top of the trolley unit one switch controls the current actuating both the burner and the water circulation. A pilot light, and additional rheostat for varying the intensity being fitted. For cavity treatment a new type of applicator holder has been devised.

A development for collective irradiation in clinics is the "Centrosol," a lamp giving a circular distribution of "sunrays," interrupted only by two narrow "shadow bands," from its twin arc tubes. These are mounted parallel and vertical within a frame on a rising pillar, so that the tube-centres can be adjusted from 24 to 32 in. above floor level. One of these lamps, at the centre of a large room, will provide for the irradiation on one aspect of a circle of patients.

The mounting of the "Centrosol" can be varied to suit conditions. Model I provides the normal mounting with remote switch control, the 12-in. base being bolted into the floor. Alternatively, Model II is made self-contained, carrying its own control unit and operator's panel on a mobile base. In either form, it is designed for use as a central unit in a planned floodlight room, with other ultra-violet ray lamps around its periphery, and with the addition of infra-red ray lamps to give a complete "sun-spectrum" irradiation.

The latest "Sollux" lamp (model V) is fitted with a 1,000-W luminous source interchangeable with a 750-W "black body" long wave infra-red emitter, specially designed for use with the 15-in. reflector. A six-step rheostat for regulating intensity, &c., is incorporated, all adjustments for distance and angle being by the counterweighted sleeve bracket, swivelled fork and axle trunnions.

An Improved Portable Sander

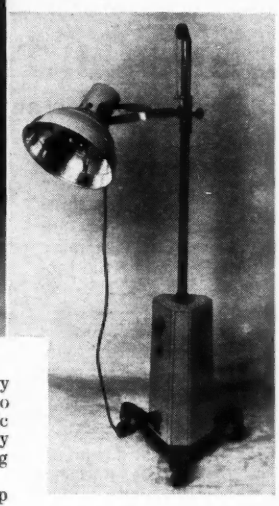
By adding electric suction to their "Duplextra" portable sander ELECTRONA ELECTRICAL PRODUCTS, LTD., Eider House, Ducie Street, Manchester, not only keep the atmosphere clean but also ensure still greater efficiency by preventing the abrasive from becoming clogged with dust. Although weighing 30 lb. the machine is so light in operation that it can be used for flatting cellulose.

The two sanding discs are 5 in. in diameter, and are friction driven at 900 r.p.m. on spring loaded self-lubricating bearings by a 0.4-h.p. motor. Spring clamps permit instantaneous changing of the abrasive.

A Multi-purpose Heater

A multi-purpose heater developed in Johannesburg is to be made in this country as soon as MR. J. O. SIPAJLO, 68, Old Compton Street, London, W.1, has made the necessary arrangements.

In addition to acting as a hot-plate, griller, toaster, plate-warmer, &c., the "Dixram," as it is called, can be mounted on a stand for use as a portable radiator. Curling irons can be heated by inserting them inside the 1¼-in. diameter cylindrical element former. The elements themselves are exceptionally robust and are claimed to have a life of 2,000 hours. They have a loading of 400-450 W and are supplied either for 100-120 V or 200-240 V.



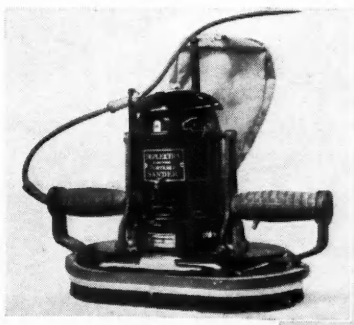
In spite of its lightness—it weighs only 1½ lb.—the apparatus is very substantially made. Mr. Sipajlo and one of our representatives actually stood on it at the same time without doing it any apparent damage. By undoing a single screw the whole of the assembly comes to pieces, thereby facilitating packing and element replacement. The apparatus is finished in chromium plating.

Improved Portable Vice

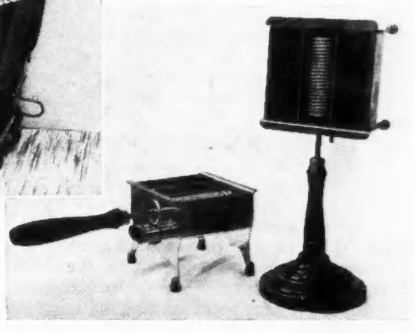
An improved type of portable vice holder made by GRANT & WEST, LTD., 3, Furlong Road, London, N.7, is of interest to the electrical installation engineer. Being telescopic it is compact and can easily be erected or dismantled. Its weight is only a quarter that of a tripod vice. Rubber end plates enable it to be fixed between door posts, window-frames, passage walls, &c., without damaging them.

A "Bedal" Upright Cleaner

We illustrate herewith the new upright external bag vacuum cleaner of BRITISH ELECTRIC DOMESTIC APPLIANCES, LTD., Kings Way, Waddon, Surrey, to which we referred in our review of the B.I.F. This is the company's first upright cleaner, and incorporates a revolving brush for removing threads from a carpet, and the 1-ft. nozzle can be adjusted by means of a thumb screw for different depths of pile. The dust bag is fixed to the main casting and three swivel wheels make the cleaner easily movable. The switch is of the sliding type controlling a 220-W motor. Black enamel and stainless steel finish is standardised and a rubber guard prevents the metal work coming into contact with the furniture.



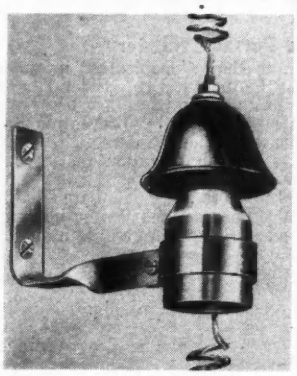
The "Duplextra" sander



Above: "Bedal" cleaner. Right: "Dixram" heater

Lightning Protection for L.v. Lines

As a result of laboratory study of artificial lightning by means of the cathode-ray oscillograph and subsequent tests under working conditions on the overhead system of a supply company in a district where thunderstorms are frequent, PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2, are introducing a new type of lightning arrestor for 400-V three-phase mains.



Lightning arrestor for three-phase lines up to 400 V

Its essential parts are a discharge gap between two solid iron electrodes and a series resistance enclosed in an airtight glass filled with a rare gas at low pressure. Further protection against the weather is provided by a porcelain hood and metal cover. A radio-active substance is incorporated in the tube which is claimed to ensure rapid action and to permit of a low dynamic breakdown voltage in the discharge gap. Risk of overheating is obviated by the large heating capacity of the solid electrodes.

The value of the series resistance varies inversely with the voltage of the circuit, falling to a low figure for conducting the excess charge to earth immediately a surge occurs and returning to its original high value as soon as the normal operating voltage is restored, so that no low-resistance earth path is maintained. Should there be a direct stroke the glass tube would be destroyed and the lower electrode left hanging down to provide an indication that it is out of action.

A Non-caustic Cleaner

Appreciating the growing popularity of electric cooking, GROSVENOR UTILITIES, LTD., 52, Grosvenor Gardens, London, S.W.1, have introduced their "Basol" non-caustic cleaner and degreasant to the electrical industry. Two equally effective forms are available, crystals and paste. The crystals are dissolved in boiling water and are claimed to remove the most obstinate carbonised fats and grease in 10-15 minutes from immersed enamelled articles. The paste, which is rubbed on, besides removing fats and grease, will also take off rust and tarnish and can safely be employed for cleaning chromium plate. "Basol" is harmless to the hands.

In addition to being supplied in bulk for supply undertakings' cooker renovation service, the cleaner can be obtained in tins and tubes for domestic use.

Grid-controlled Traction Rectifiers

Equipment for an Indian Railway

IN 1928 the original electrified section of the Bombay, Baroda and Central India Railway was put into service. It extended as far as Borivli, twenty miles north of Bombay on the main line, and was supplied with energy from three rotary-convertor sub-stations remotely controlled from Bombay station. A further sixteen miles, to Virar sixteen miles beyond Borivli, was electrified in 1936; this entailed the provision of a further sub-station at Bassein Road, half-way between the two towns—with overhead equipment sectionalised in cabins at five points. For converting a 22-kV, 50-cycle supply (taken from the 110-kV transmission system) to 1,500 V d.c., two 2,000-kW Hewittic twelve-phase, six-glass-bulb rectifiers were installed. These were required to operate in parallel with the existing over-compounded rotaries and to give a voltage characteristic rising from 1,530 V at no load to 1,550 V at full load, at the same time automatically compensating for a transmission line drop up to 10 per cent. Overloads called for were 25 per cent. for two hours, 50 per cent. for 15 min., twice full load for five minutes and three times full load momentarily.

The following percentage efficiencies have been obtained on test (including transformer and auxiliary gear): 85 at 1¼ load, 96.5 at full and ¾ loads, 96.4 at ½ load and 95.2 at ¼ load; no-load losses are 12 kW. All the main bulbs are fitted with control grids, one per anode, and the grid-control circuit is governed by means of a paralleling control device together with a voltage and load compensating system.

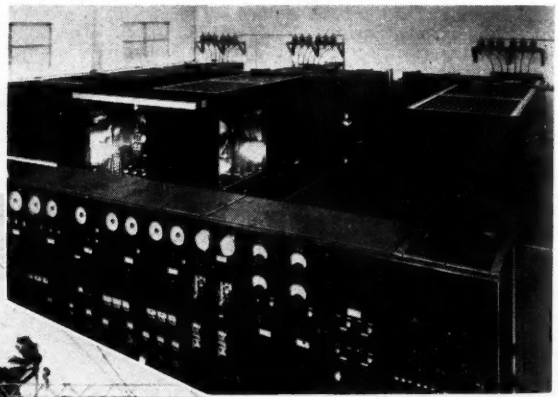
A typical station on the electrified section and part of the interior of the rectifier sub-station at Bassein Road

A main anode cannot start up, even though it has a potential positive to cathode, until the grid becomes positive to cathode. Once it has started up, the grid has no further control of the arc and the anode will continue to carry current until it becomes negative to cathode. By retarding the point in the cycle at which the grid becomes positive to cathode, the anode is caused to strike at a later point, decreasing the average value of d.c. volts over a cycle. Thus, by altering the phase-angle of the grid supply, the main d.c. volts may be varied from the value for a normal rectifier down to zero.

Instantaneous positive impulses must be given to each grid at the point in the cycle requisite for starting the main anode. Impulse control is needed to secure correct parallel operation of a bank of large bulbs and also to give the correct load sharing on the multi-phase secondary output. The impulse generator is a miniature replica of the main equipment.

Phase-angle displacement between the main anodes and the control grids is varied by altering the position of the rotor of an induction regulator relatively to its stator. A device, direct-coupled to the inductor regulator, responds to voltage variations of approximately ½ per cent., completing a correction for load output or input supply fluctuations within 0.1 sec. Smoothing equipment comprises a reactance coil in the negative feed from the transformer neutral and 600- and 1,200-cycle filters.

The transformer is of the oil-immersed, naturally cooled core type connected in delta three-phase on the primary side and in zig-zag twelve-phase on the secondary side, with inter-phase transformers between the neutral points. Surge arrestors are connected to the secondary terminals of the main transformers.



For controlling the 22-kV supply Reyrolle metal-clad, compound-filled switchgear has been installed; this comprises two units for the incoming feeders, two for the rectifiers and a bus coupler. On the d.c. side are two rectifier and four-feeder Met.-Vick. high-speed breakers in withdrawable trucks, all operated from the main sub-station control board. The high-voltage switchgear, the transformers and the rectifier plant control board, together with the d.c. switchgear, are enclosed in three separate sections of the building.

The whole of the sub-station plant was manufactured to the specification of Merz and McLellan, consulting engineers to the Railway Co.

The Wholesalers' Dinner

The value of trade associations stressed

THERE was a company of about 400 at the annual dinner of the Electrical Wholesalers' Federation held at the Savoy Hotel, London, on March 17th. The president, Mr. A. B. Wildsmith (Young & Wildsmith, Ltd.), was in the chair and the guest of honour was Lt.-Col. J. T. C. Moore-Brabazon, M.C., M.P.

The toast of the Federation was submitted by Lt.-Col. Moore-Brabazon who, in amusing terms, recalled his connection with the 1926 Act as the then Minister of Transport. His speech then ranged over such matters as the development of flying and radio, and the electric razor to which he gave a personal testimonial.

He then went on to say that although wholesalers were often contemptuously referred to as "middlemen," the large manufacturers had recognised their value in the distribution of goods from the factories. Referring to the prospective Electricity Bill he warned his audience that if they had any proposals to make they should be made at once before the Bill was printed. Once a Bill appeared in print the minister in charge of it felt it a matter of prestige to resist amendments.

In the course of a reply to the toast Mr. Wildsmith regretted that Lt.-Col. Moore-Brabazon had not been able to reveal anything of the Government's intentions towards the industry. The introduction of the Bill had no doubt been delayed by weightier matters. He thought, however, that the delay had been of advantage; it had enabled the various sections of the industry to get together and already much good had come from the discussions.

He expressed his Federation's appreciation of the goodwill shown to it by the B.E.A.M.A. and the E.C.A. They were all anxious to help the Government to produce a Bill which would consolidate the position of the industry. The commercial side asked for security of tenure so that its expenditure of money and brains should not be nullified by the whims of cliques with axes to grind. He believed that the desired end would be obtained by co-operation rather than inter-sectional competition.

Mr. T. Woods proposed the toast "Kindred Associations," and in his remarks maintained that the Wholesalers' Federation stood not only for the protection of its own membership, but also for the well-being of the whole industry. Its principal function was to provide a consistent and reliable channel from the manufacturer to the trade purchaser. The members realised the necessity for the exercising of tolerance and the respecting of the points of view of the other sections. He welcomed particularly Mr. V. Watlington, Director of B.E.A.M.A., and Mr. A. E. Iliffe, chairman of the Industrial Fittings Section of the Electric Light Fittings Association.

Mr. Watlington, in replying to the toast, reprobated the individual or firm who would not join the appropriate trade association although enjoying all the benefits which that association secured. It was not merely a desire to preserve their independence which animated such "rugged individualists." Almost as bad were those who joined their association and left all the work to other people—generally the staff. A strong association sometimes abused its strength and attempted to impose its conditions upon others; it was better to aim at co-operation rather than dictatorship. Associations played a most important part in the organisation of an industry. He urged that the electrical associations should make greater efforts to build up a united industry.

Mr. Iliffe, who also responded, assured the Federation of the continued support of his Association. It was reasonable to expect, he said, that associations should study the final economics of their industry and not merely their own immediate problems. He thought that every section should have protection and due recognition of its place in the industry, and hoped that the sections in working to protect their own interests would also seek to serve the industry as a whole.

The chairman's health was toasted by Mr. W. Yuille (vice-president) and Mr. Wildsmith briefly replied.

During the evening a collection taken up for the E.I.B.A. realised £25.

The E.C.A. and the Ironmongers

Advice to I.F.A. members

EARLY last year the Electrical Contractors' Association formed the National Association of Electrical Retailers to look after the retailing interests of its own members and those of electrical traders who were not also contractors. As a result of correspondence and discussion there was later a meeting between the Director and Secretary of the E.C.A. (Mr. L. C. Penwill) and the Executive and Electrical Committees of the Ironmongers' Federated Association. At this meeting Mr. Penwill explained the nature of the N.A.E.R. He stated that the annual subscription was one guinea but that members of the E.C.A. accepting membership of the new organisation would have one guinea of their present subscriptions transferred to the new body.

According to a circular sent last week to members of the I.F.A. it was proposed that the Electrical Section of that organisation should be disbanded, members joining the N.A.E.R. as individual firms. The Council of the new Association would then be formed from members of the E.C.A. and representatives of the ironmongers.

The I.F.A., while recognising the desirability of close co-operation between all parties interested in the electrical industry, could not agree that any benefit would accrue from abandonment of its electrical activities. It said: "Apart from the power supply interests and the departmental stores there are three normal retailers of electrical goods: the ironmonger who is equipped and handles electrical goods as a department of his business; the contractor who may have a small retail department; and the radio retailer." The contractor and radio retailer already had organisations for their protection; the ironmonger looked to the I.F.A. in respect of the whole range of commodities covered by his various departments. In these circumstances the Federation "naturally and properly feels that it would be wrong for it to take part in any movement which would tend to result in the future in establishing a separate trade with a purely theoretical existence—an electrical retailer."

Co-ordinating Committee Proposed

It was, therefore, suggested that the I.F.A. Electrical Section should be "retained, developed and expanded," and that it should collaborate with the N.A.E.R. in the establishment of a co-ordinating committee for the purpose of reaching joint agreement upon matters affecting retailers of electrical apparatus and ensuring that any action taken by the two bodies would be along parallel lines.

According to the I.F.A. this offer of co-operation has not been accepted and it recommends members of the Electrical Section not to join the N.A.E.R., directing attention to a number of points. It is considered that the views of contractors (which may not always be acceptable to ironmongers) will dominate the policy of the N.A.E.R.; that the electrical interests of the ironmongers are properly the concern of the I.F.A.; and that as the ironmongers are the principal retailers of electrical appliances no organisation of such retailers can claim to be representative without them.

Under the heading "Electrical Committee" in its last quarterly report the I.F.A. says that a further application for membership of the Fair Trading Council has been made. B.E.A.M.A. has been requested to consider the maintenance of hire-purchase prices to prevent Corporations cutting rates on electrical appliances. Action has been taken to assist Southend members in fighting a proposal of the Electricity Department to extend its activities. Inquiries are being made as to a scheme of insurance to cover claims for damages resulting from defective electrical appliances sold by members in good faith.

Electrodes for Welding

A new specification, which covers electrodes suitable for use in the construction of ships, is intended primarily to indicate the tests with which a particular class of electrode should comply before it will be approved by the registration authorities as being suitable for use in metal arc welding. But it also provides for periodical check tests to be made on electrodes that have been approved. The specification calls for tensile and bend tests on butt welded joints and tensile tests on two forms of fillet weld test pieces. It also lays down tensile, bend and impact tests on all-welded metal test pieces. The requirements embodied are those which were originally prepared by the Board of Trade in collaboration with the classification societies, and in consequence the forms of the test pieces to be used in one or two of the tests are not similar to the forms previously included in other specifications. Copies of this specification (No. 782) can be obtained from the British Standards Institution, 28, Victoria Street, S.W.1, price 2s. or 2s. 2d. post free.

Parliamentary News (BY OUR SPECIAL REPORTER)

Control of Non-statutory Undertakings

On March 16th Mr. G. Strauss asked the Minister of Transport whether, in view of his decision to postpone the proposed Electricity Bill, he would introduce a short measure which would either bring under some form of statutory control the prices charged to consumers by the Fixed Price Light Co., or provide for this company to be taken over by a statutory undertaker.

Mr. Burgin said he would not, but he was considering what provisions should be inserted in the Bill to deal with non-statutory undertakings.

Basis of Charges

Mr. G. Strauss asked the Minister of Transport whether he was aware that certain electricity companies refused to tell their consumers the basis on which they fixed their flat-rate charges; and whether he would include in his forthcoming electricity legislation provision to compel statutory undertakings to inform the public the basis on which their charges were calculated.

Mr. Burgin said he was aware of the fact. It was intended to require statutory undertakers to make their scale of charges available to the public.

Coal Prices Inquiry

On March 16th,the Prime Minister, in reply to Miss Ward, said that it had been decided to set up a Departmental Committee, composed of persons independent of the interests affected, to inquire into the organisation and methods of distribution of coal, coke and manufactured fuel; to investigate the various items which made up the differences between the prices received by the producers and those paid by the consumers, and to make recommendations. These terms of reference did not include any inquiry into the operation of the coal-selling schemes themselves, but the operation of distributing companies, whether or not they were subsidiary companies of collieries, would fall within their scope.

N.W. Midlands J.E.A. Finances

On March 17th a Bill to confirm a Provisional Order granted by the Minister of Transport to the North West Midlands Joint Electricity Authority was considered by the Select Committee of the House of Commons on Unopposed Bills. Capt. R. C. Bourne presided

Mr. A. Clark, of the Ministry of Transport, informed the Committee that the J.E.A. had already applied to the Electricity Commissioners for sanction to borrow for various purposes sums amounting in the aggregate to £179,000; and the Commissioners had already cancelled to the extent of £50,000 sanctions to borrow which had already been issued so as to enable other and more urgent sanctions to be given within the present limit of the Authority's borrowing powers. Further sanctions would be required in respect of those which had been cancelled and therefore the outstanding and immediate requirements of the Authority amounted to £229,000. The balance of the additional £1,000,000 proposed to be allowed by the Order was required by the J.E.A. for the purposes of general development of generation, transmission and distribution and the further development of existing schemes for the hire and/or hire-purchase facilities offered to electricity consumers.

After formal evidence the Committee ordered the Bill to be reported for third reading.

London and Home Counties J.E.A.

Mr. Liddall asked the Minister of Transport if he would obtain and publish a synopsis of the existing relative information or, alternatively, set up a departmental inquiry to ascertain what schemes had been proposed by the London and Home Counties Joint Electricity Authority, acting as a judicial body, for consolidating and improving the electricity supply in the London and Home Counties area during the two separate periods 1925 to 1932 and 1932 to 1938; and could he now state which of the Authority's proposed schemes had been put into operation.

Mr. Burgin said that particulars of the various proposals of the Joint Electricity Authority for consolidating and improving the supply in the London and Home Counties Electricity District would be found in the annual reports of the Authority and of the Electricity Commissioners covering the periods up to March, 1937. The schemes to which effect had been given were those to which the following Orders and Act related:—The London and Home Counties Electricity District (Amendment) Order, 1931 (Thames Valley Scheme); the London and Home Counties Electricity District (Amendment) Order, 1932 (Mid-Surrey Scheme); and the Colne Valley Electricity Act, 1936 (North-West Middlesex Scheme).

In the Courts

Action Against Glasgow Corporation

The Town Clerk having reported to Glasgow Corporation Electricity Committee that a complaint had been taken in the Sheriff Court against the Corporation at the instance of occupiers of certain premises in the city, with the concurrence of the Procurator-Fiscal, for failing to supply electric energy to those premises in terms of the Corporation Electric Lighting Order, 1890, the Committee agreed that the Town Clerk should be instructed to defend the action.

Theft of Electricity

A fine of £2 and £1 1s. costs was imposed at Glastonbury last week on Chas. E. Trott, of Street, Somerset, for unlawfully laying an electric line to connect with lines the property of the Mid-Somerset Electric Supply Co., Ltd.

A meter reader, giving evidence, said that he was kept waiting at the door of the house when he called to read the meter and while waiting saw through the fanlight of the door a hand go up to the meter. Then the wireless stopped. On emptying the meter he found that the last 1s. put in had been exhausted. A similar thing occurred on two subsequent occasions when he visited the house.

Trott declared that the only time the meter had been "shorted" was when a shilling had failed to deliver current.

Warner's Radio & Electric, Ltd.

In the Companies' Court on Monday last Mr. Justice Bennett had again before him the petition for the compulsory winding-up of Warner's Radio & Electric, Ltd.

Mr. J. G. Strangman, for the petitioning creditors, said that since the last hearing the company had gone into voluntary liquidation, and joint liquidators and a committee of Inspection had been appointed. His clients would have preferred a compulsory winding-up order, but an overwhelming body of the creditors had perfectly clearly expressed the view in favour of a voluntary liquidation.

His Lordship dismissed the petition and directed that the taxed costs of the opposing creditors and of Warner's Radio and Electric, Ltd., should be paid in the liquidation.

Telsen Electric Co. v. Eastick

An action brought by the Telsen Electric Co., Ltd., against J. J. Eastick & Sons was in the list for hearing in the Court of Appeal before Lords Justices Greer, Slesser and Clauson on Tuesday last on an interlocutory appeal by the defendants from an order of Mr. Justice Lawrence in chambers.

Before the hearing of the appeal was reached, Mr. Gordon Clark asked that it might be postponed, stating that there was a prospect of all the matters involved in the litigation being disposed of. The reason for delay was that it was necessary for them to go again before Mr. Justice Lawrence, and that was not possible before March 25th, as the judge was then on circuit. As the questions involved in the case were rather complicated, it was thought better to get an order of the Court. Mr. Valentine Holmes, who appeared against him (Mr. Clark), assented to the application but was unable to be present.

The Lords Justices assented to the application.

The I.M.E.A. Convention Programme

SINCE the issue of the preliminary programme for the annual convention of the Incorporated Municipal Electrical Association (Torquay, May 23rd-27th) there have been certain changes in the arrangements. We accordingly reproduce the revised programme below:—

Monday, May 23rd.
3 p.m. Official opening of I.M.E.A. Exhibition, Torwood Street.
8.15 p.m. President's reception at the Town Hall.

Tuesday, May 24th.
9.50 a.m. The Pavilion. Opening of Convention by the Mayor of Torquay. Presidential address: Mr. W. J. Bache.
2.30 p.m. Paper on "Automatic Central Control with reference to Street Lighting," by Messrs. E. E. Hoadley and H. P. Barker.
8.15 p.m. Reception by the Mayor and Mayoress of Torquay at the Town Hall, followed by a ball.

Wednesday, May 25th.
10 a.m. The Pavilion. Paper on "Present Trends of Power Station Practice," by Messrs. H. C. Lamb and K. Baumann.
2.15 p.m. Informal discussion on the Government's proposals for the reorganisation of electricity distribution, to be opened by Alderman Sir Percival Bower and Mr. W. P. Lilwall, A.M.I.E.E.
4 p.m. Garden party.

Thursday, May 26th.
10 a.m. Paper on "Hire Purchase Law and its Application to Municipal Electricity Supply Undertakings," by Councillor F. E. Sugden.
1.15 p.m. Luncheon: Electrical Association for Women.
2.30 p.m. The Pavilion. Paper on "Air Conditioning," by Capt. J. C. Chaytor.
7.30 p.m. Annual banquet and ball at Town Hall.

Friday, May 27th.
10.30 a.m. The Pavilion. Annual general meeting.

Business and Industrial Notes

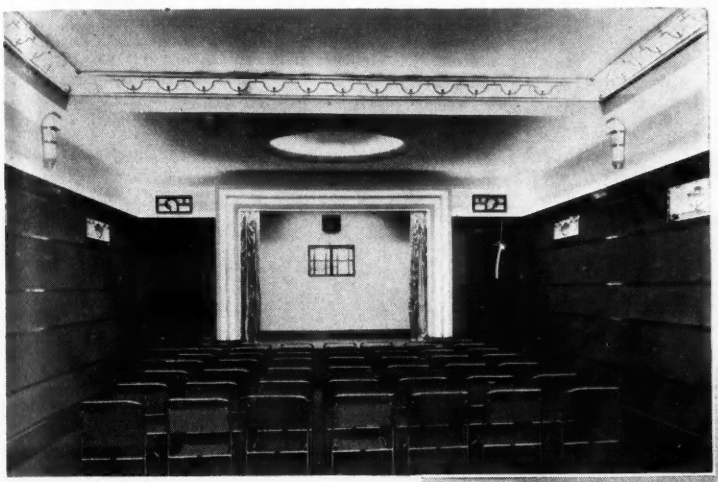
The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Sheffield Contractors' Dinner

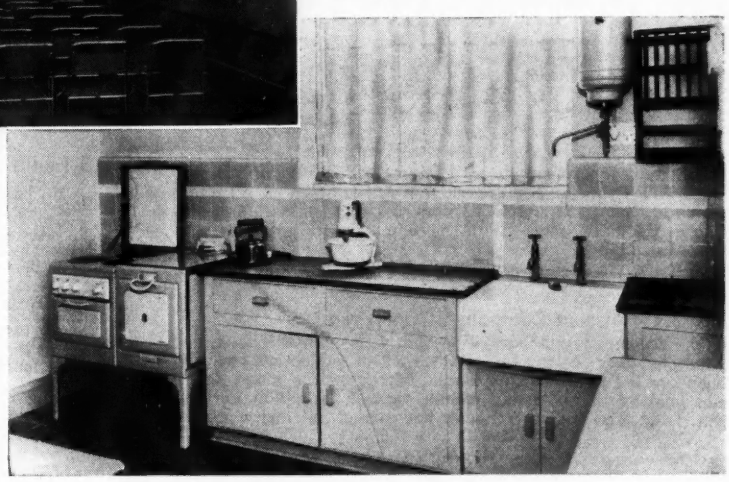
Mr. John R. Struthers, general manager of the Sheffield Corporation Electricity Department, speaking at the recent annual dinner of the Sheffield branch of the Electrical Contractors' Association, said that when the extensions to the Blackburn Meadows and Neepsend power stations were completed the Corporation would be in a better position than ever to give cheaper electricity. He forecast a reduction in prices in the near future. It was expected, he said, that by the end of the financial year the Department would have sold 500 million kWh with a revenue of nearly £1,500,000. Mr. H. E. Walker, of Birmingham, President of the Association and allied organisations, in the course of his speech, commended the Department for the cheapness of its supply.

Blackburn Showroom Extension

The newly erected demonstration theatre at Blackburn Corporation electricity showrooms was opened on March 16th. The auditorium of the new theatre is 35 ft. by 22½ ft. and is tastefully designed. Above the panelled walls of oak veneer the cornices and arched ceiling have been moulded to allow of special effects in illumination, in which the Department has collaborated with the General Electric Co., Ltd. There are three main systems one of which achieves a rainbow effect in two shallow domes. The stage proscenium is outlined by a soft radiance of light from a concealed source, and among other details are large mirrors surrounded by strip-lighting which gives perfect illumination without glare. Behind the theatre is an all-electric kitchen equipped with cookers and refrigerators. Amplification apparatus is installed to relay gramophone record music, or for direct amplification. The auditorium is furnished with modern tubular metal chairs, and there is accommodation for over 100 people. Instead of ordinary pendants or built-in fittings the contours of the theatre have been used to accommodate new lighting features embracing alternative types of fittings. These comprise cornice and trough lighting, colour pools, wall panels, reflected light by means of recesses, and laylights. Apart from the main illumination there is special feature lighting which includes mirror and decorative recess effects. The stage lighting has been obtained by a special type of proscenium and soffit reflected lighting.



Blackburn electricity showrooms



Gravesend Electrical Exhibition

Ald. J. W. Clunn, chairman of the Gravesend Corporation Electricity Committee, at the opening of the Electricity Department's annual exhibition at the Town Hall on March 14th, said that they were nearing saturation point so far as new consumers were concerned. From March to December, 1937, about 500 new consumers were added, whereas at one time they could claim 2,000 per year. Despite this, the output was still increasing greatly. In Gravesend to-day there were 2,035 electric cookers and 2,289 water heaters and boilers installed. They were pushing the sale of refrigerators, and though they only started fifteen months ago 90 were now in use. The exhibition was opened by the Mayor (Councillor A. W. Howcroft). Demonstrations were given by Miss M. A. Weedon, of the Jackson Electric Stove Co., Ltd., assisted by Miss Broadhurst, of the Corporation sales staff. The Gravesend branch of the Electrical Contractors' Association had a joint stand.

Import Duties on Iron and Steel

The Import Duties Advisory Committee calls attention to the fact that the period for which reduced rates of Customs duties on certain iron and steel products were established as a temporary measure will expire on March 31st. The Committee does not propose to make any recommendation for the continuance of reduced rates of duty on those products after that date.

The G.P.O. at the Empire Exhibition

The largest display of Post Office organisation ever undertaken will be seen at a special 10,000 sq. ft. pavilion being erected at the Empire Exhibition, Glasgow. Surmounting the pavilion will be a 50-ft. radio mast, on which will shine a red flashing beacon. Inside the pavilion a replica of an operating room in a coast radio station will show how the Post Office keeps in contact with and watches over the safety of the fishing fleet. A special feature of the building will be the lighting of the roof, which at times will seem to disappear, leaving the visitor under the impression that he is looking up at the open sky. The public will be able to see how the automatic speaking clock works, and there will also be a full-sized train from the tube railway which links the main railway termini with the G.P.O. The G.P.O.'s research work will be represented.

Electrical Golfers

The Lancashire and Cheshire Radio Industry Golfing Society has decided to admit to membership in the Society members of the electrical trade. An interesting programme has been arranged for the coming season, and particulars can be obtained from Mr. H. Hackett, hon. secretary, 18, Roxton Road, Heaton Chapel.

A Builders' Guide

The 1938 edition—the 121st—of "Laxton's Builders' Price Book" has just been published by Kelly's Directories at 10s. 6d. post free. It combines in one book a great deal of information which could otherwise only be obtained from a variety of sources. Apart from the prices given it contains particulars of the various sources of supply of materials, &c., and enables comparison to be made between alternative materials and methods of construction. The Timber Marks section has again been revised to give up-to-date and helpful information on this subject. The book is divided into trade sections covering all branches, and all items are listed in a very full index. The tables and memoranda section give the weights of many building materials and other useful data and mathematical tables. The chapter entitled Legal Notes and Memoranda has been thoroughly revised and brought up to date in conformity with the latest decisions in the Courts. The list of proprietary articles and trade names (blue pages) has been revised and extended, and the book includes the standard rates of wages for the building trades of England and Wales, in-

cluding regradings, which came into force on February 1st last. A comparative table is also given showing the principal variations in wages and materials during the past five years.

The South London Exhibition

An opportunity for residents in the Crystal Palace district to see much of the latest electric labour-saving devices is at present being provided by the South London Exhibition, which in temporary canvas pavilions enables some two hundred firms to show their products. Vacuum cleaners especially are in evidence, and visitors appear to be taking particular interest in the new Hoover model and in the various other up-to-date machines shown by the Tellus Super Vacuum Cleaner, Ltd.; Harles ("Hotpoint"); the British Vacuum Cleaner & Engineering Co., Ltd. ("Goblin"); and the Hurley Machine Co. (England), Ltd. The last-mentioned two companies, together with Beatty Bros., Ltd., and Servis Electric Washers have also taken advantage of the growing interest in electric laundry equipment to show selections of their washers and ironers. A full range of the new "Goblin" electric clocks is to be found on a separate B.V.C. stand, and the new eight-in-one "Dixram" electric cooker and heater appears on the stand of J. O. Sipajlo. Other electrical items include radio and television sets (D. L. Kings & Co.), table cookers (Stokes Appliances, Ltd.), electric massage equipment (Ideal Home Electrical Appliances, Ltd.), deafness aids (Fortiphone, Ltd.), and miscellaneous appliances (Electroservice, Ltd.).

The Birmingham Electric Club

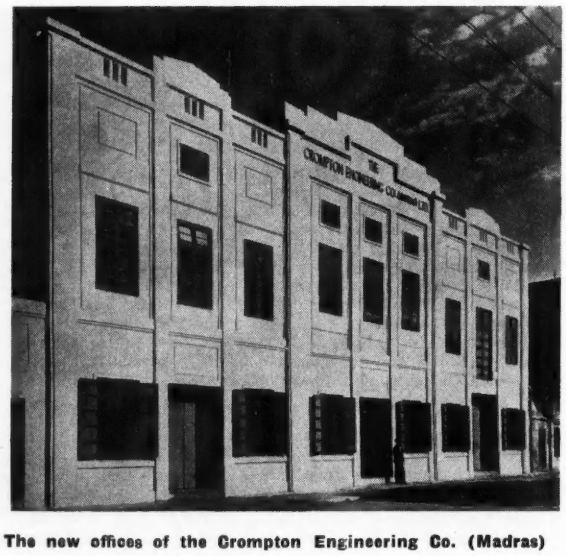
The Birmingham Electric Club proposes to hold spring and summer golf meetings this year. The spring meeting will be held on April 11th at Harborne Golf Club. Particulars can be obtained from Mr. A. T. Haywood, hon. social secretary, 24, Tamworth Road, Sutton Coldfield.

E.D.A. Sales Programme

E.D.A. draws attention to "reminder" advertising in its Sales and Publicity Programme for April, and has prepared a number of small stereos suitable for regular weekly insertion in the local Press. With the approach of longer evenings the usefulness of poster advertising increases, and the programme contains a price list of double-crown and 16-sheet posters.

Indian Company's New Premises

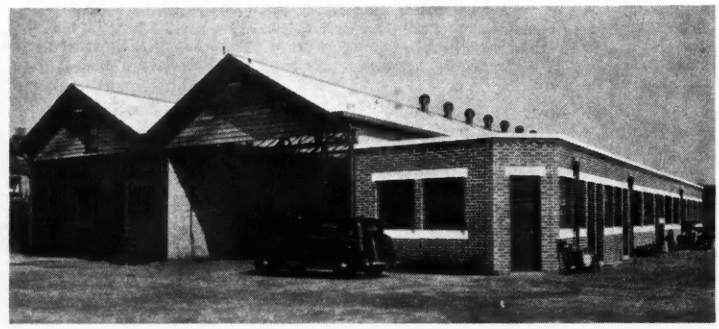
The accompanying illustration shows the new offices of the Crompton Engineering Co. (Madras), Ltd., which has recently been erected at First Line Beach, Madras. The many agencies held by this company include that of Crompton Parkinson, Ltd. The Indian company has carried out many important contracts for Government Departments, municipal supply authorities and mining companies in South India.



The new offices of the Crompton Engineering Co. (Madras)

Switchgear Works Extensions

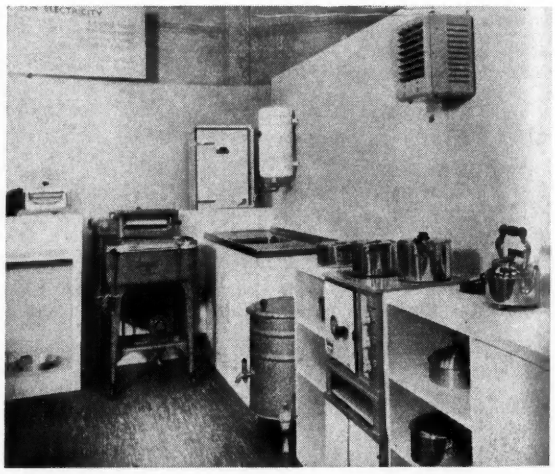
George Ellison, Ltd., have recently completed alterations and extensions to their works at Perry Barr, Birmingham. In order to release space for workshop extensions the canteens and kitchen, which were formerly contained in the main works building, have been accommodated in the new premises. The new building, which is shown in the accompanying illustration, stands on a part of the playing fields adjoining the works, and by arranging the main sports pitches it was not necessary to reduce the number to accommodate the building. As will be seen, the garage and car-wash have been built at one end of the two main bays. The other part of these two bays is taken up by the canteen. The flat-roofed bay on the right of the photograph contains the staff dining room, the kitchen, sports changing rooms and headquarters of the Athletic and Recreation Club. The works canteen has a seating capacity of 500, and is used from time to time for social events. Although the removal of the canteens and kitchens released considerable floor space for workshop extensions, still more space was required. To meet this need two more bays have been built at the side of the main works. They cover an area of about 6,000 sq. ft. and are constructed in such a way that extensions can readily be made when the need arises.



Part of the new extensions at the works of George Ellison, Ltd.

Electricity in the Kitchen

An exhibition now being held at the Building Centre, London, shows how electricity can improve conditions in the kitchen and at the same time make the home as a whole a healthier and happier place to live in. The central portion of the display indicates the layout of a typical all-electric kitchen. An electric cooker is arranged with its top flush with a built-in table-cum-cupboard on each side, and a double sink with a water heater above has space at its sides for a wash-boiler and a washing machine. A refrigerator forms one of the components of a cabinet comprising a larder, provision cupboard and ironing-board recess, and to complete the equipment there are an air circulator and a clock, an adequate number of plug points being provided for kettle, toaster, iron, vacuum cleaner, &c. A selection of photographs shows model all-electric kitchens in various buildings. Separate sections of the exhibit arranged round the walls contain specimen apparatus and call attention to the particular uses and advantages of each type. The point that electric lighting fittings give the finishing touch to a well-decorated house is made in the lighting section, and in connection with electric cooking cleanliness, dependability and uniform heating are stressed. "Safe Food" is the slogan adopted for refrigeration, and visitors are reminded that modern methods of wiring make it possible to install electricity with minimum disturbance and expense.



A corner of the model kitchen layout at the "Electricity in the Kitchen" Exhibition at the Building Centre

Trade Announcements

The London office address of Petters, Ltd., is now Terminal House, 52, Grosvenor Gardens, London, S.W.1. Telegrams: Escapable Sowest London. Telephone: Sloane 8258-9.

Amplivox, Ltd., has removed to 2, Bentinck Street, London, W.1.

Mr. W. Kupfer has taken over the electrical department of Bettmann & Kupfer, Ltd., and has been joined by Mr. E. Kupfer. The name of the firm is W. & E. Kupfer and

the address is Byron House, 2 and 4, Finsbury Street, E.C.2.

Mr. D. Inman, electrical and radio factor, Nile Street, Lancaster, has closed down his branch at 92, Arundel Street, Sheffield.

Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable-making Industry reports that the cost of living figure on March 1st (56 per cent. above the 1914 level) will not involve any alteration in wages on the third pay day in April.

Employment in February

Employment in the engineering industry in February showed a slight decline in most districts, but remained good in electrical engineering. According to the *Ministry of Labour Gazette*, the number of unemployed in the engineering industry was 79,202, an increase of 5,414, or 0.4 per cent., as compared with January, and an increase of 1.2 per cent. as compared with February, 1937. In the electrical engineering section the number of unemployed was 5,222, or 4.6 per cent. (4.3 per cent. in January and 3.5 per cent. in February, 1937). The unemployed in the electrical wiring and contracting industry totalled 4,373, or 10.6 per cent., showing a fall of 0.2 per cent. as compared with January, and an increase of 0.3 per cent. on February, 1937. In the cables, apparatus, lamps, &c., group the unemployed numbered 16,583, the percentage rising from 8.1 to 9.3. This compared with 6.1 per cent. in February, 1937.

Ironmongers' New Constitution

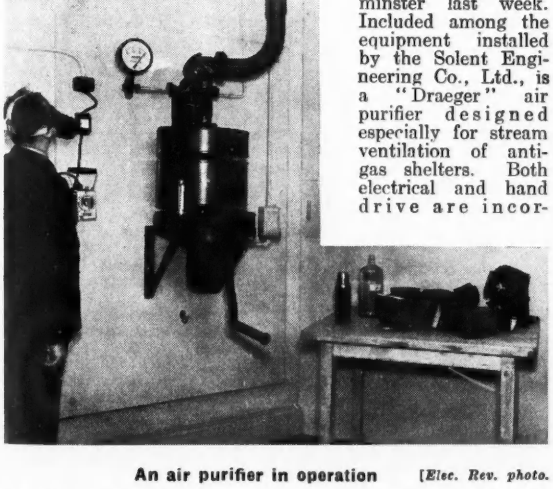
At the annual conference of the Ironmongers' Federated Association last year it was decided to adopt a new constitution enlarging the objects and powers of the Association. This has now been approved and circulated to members. As from April 1st the organisation will be known as the National Federation of Ironmongers. The methods of administration remain unaltered, but the functions of the reconstituted body are extended to include price maintenance to which members will be expected to conform. A Trade Protection Committee will be set up under an independent chairman to administer this, and a "stop list" is to be prepared and issued to members. Powers are taken to conduct negotiations on wages and conditions and arbitration in disputes between members or between members and other parties is provided for.

An Electrical Supplement

The *Daily Telegraph and Morning Post* on Monday last issued a supplement containing particulars of the grid system and articles by well-known authorities on various aspects of the electrical industry. Among the contributors were Mr. M. J. Railing (vice-chairman and joint managing director of the G.E.C.), Mr. G. H. Nelson (chairman and managing director of the English Electric Co., Ltd.), Miss C. Haslett (director, E.A.W.), Sir Geoffrey R. Clarke (managing director, Telegraph Construction and Maintenance Co., Ltd.), Mr. G. Martinez (Pirelli-General Cable Works, Ltd.), Mr. P. J. Robinson (Liverpool city electrical engineer), and Mr. W. H. Scott (chairman, Laurence, Scott & Electromotors, Ltd.).

Air Purifiers for Anti-gas Shelters

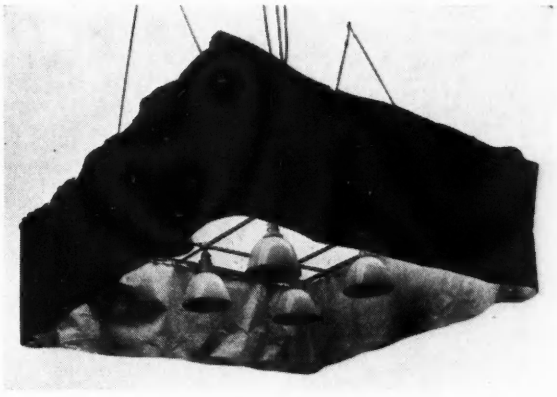
In the basement of the St. Martin's Street public library, Leicester Square, London, an air-raid shelter was opened by the Mayor of Westminster last week. Included among the equipment installed by the Solent Engineering Co., Ltd., is a "Draeger" air purifier designed especially for stream ventilation of anti-gas shelters. Both electrical and hand drive are incorporated. An airometer shows the correct functioning of the filter. There are three models of purifier available, No. 12a (0.3 cu. m. per min.) for up to 50 people, No. 24 (0.6 cu. m. per min.) for up to 100 people, and No. 14a (1.2 cu. m. per min.) for up to 200 people. These are driven by motors which can be supplied for 110- or 220-V d.c., 127- or 220-V a.c., single-phase or 220/380 V three-phase.



An air purifier in operation [*Elec. Rev. photo.*

Orders Recently Booked

The Simplex Electric Co. has just completed an order for the Air Ministry for special lighting equipment for the illumination of a portable boxing ring. The equipment, which has been designed to withstand the effects of tropical heat, humidity and driving sand, consists of nine 500-W concentrating type "Displex" reflector units, arranged in three rows of three each, and supported by a tubular framework. This in turn is fixed to an angle-iron framework 10 ft. sq. which carries a curtain rail of the standard brass girder and roller type. From this is suspended a canvas curtain 3 ft. 6 in. deep which is painted matt-white inside and serves to screen the equipment from the view of the audience and concentrate the light on to the boxing ring. All the necessary wiring is carried in the tubular supporting framework, with a connection box above each reflector.



Simplex lighting equipment for a portable boxing ring

The whole fitting is suspended by means of two steel wire ropes which are carried by means of pulleys along the roof and thence down one of the walls to a double-drum hand-operated winch. The metalwork is galvanised or rustproofed.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price March 23rd.	Fortnight's Inc. or dec.
a Acid Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal)... ,,	£18 10s.	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£22 10s.	—
a Potash, Chlorate ... ... per lb.	3½d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur, Commercial ... ... per ton	£11	—
a ,, Roll... ... ... ,,	£11	—
a Soda, Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a ,, Crystals ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. net.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil... ... ,,	1/3 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£177	—
Grade II ... ... ,,	£125	—
Grade III... ... ... ,,	£72	—
c Brass (rolled metal 2" to 12" basis)... per lb.	7¼d.	—
c ,, Tubes (solid drawn) ... ... ,,	11¼d. to 11¼d.	—
c ,, Wire, basis ... ... ,,	8¼d.	—
c Copper Tubes (solid drawn) ... ... ,,	1/0½	—
g ,, Bars (best selected)... ... per ton	£75	—
g ,, Sheet... ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£44 10s.	7s. 6d. dec.
d ,, ,, Wire Rods ... ,,	£49	17s. 6d. dec.
d ,, ,, H.C. Wire ... per lb.	7¾d.	⅛d. dec.
f Ebonite Rod ¼" dia. & up ... ... ,,	1/10 to 2/5	—
f ,, Sheet ⅛" thick & up ... ... ,,	1/5 to 1/10	—
n German Silver Wire, Nos. 1 to 12... ,,	2/4	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para-fine ... ... ,,	5¾d.	¼d. dec.
i Iron, Pig (Cleveland, No. 3) ... per ton	£4 5s.	—
i ,, Wire galv. No. 1 P.O. Qual.... ,,	£23	—
g Lead, English Pig ... ... ,,	£18 15s.	£1 10s. inc.
g Mercury ... ... per bot.	£12 10s.	5s. dec.
e Mica (in original cases) small ... per lb.	10d. to 2/–	—
e ,, ,, ,, medium ... ,,	6/– to 12/6	—
e ,, ,, ,, large ... ,,	13/– to 17/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/2¼	—
p ,, ,, drawn bars & rods ,,	1/1¼	—
p ,, ,, rolled strip & sheet ,,	10¾d.	—
p ,, ,, wire ... ... ,,	1/0¾	—
o Platinum ... ... per oz.	£7 10s.	—
d Silicium Bronze Wire ... ... per lb.	8¾d.	⅛d. dec.
g Spelter ... ... per ton	£14 13s. 9d.	12s. 6d. dec.
g Tin, Block (English)... ... ... per ton	£185 10s.	—
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/3	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

The E.C.A. Conference

This year's annual conference of the Electrical Contractors' Association and allied organisations is to be held at Hastings from June 22nd to 24th.

Liverpool Contractors' Dinner

The annual dinner of the Liverpool and District branch of the Electrical Contractors' Association was held at the Exchange Station Hotel, Liverpool, on March 16th, when Mr. R. Harrison Watson, chairman of the branch, presided. While complimenting the E.C.A. on its growing strength, Mr. E. E. Spencer (Birkenhead) expressed regret that there was still apathy in some of the branches. It was gratifying that much happier feelings existed between contractors and the supply authorities. There were many houses still waiting to be wired—he believed the figure was about 4,500,000. Ald. F. Wilson, chairman of the Liverpool Electric Power and Lighting Committee, expressed appreciation of the work of the Association in maintaining a high standard of workmanship. The Corporation was getting good service, the load was developing, and the public was being well served.

Works Visit

A party of electrical retailers from Ipswich recently paid a visit to the works of Smiths' English Clocks, Ltd. Headed by Mr. Driesson, of Messrs. Flinders, a tour was made of the machine shops, stores and assembly section, and after lunch a visit was paid to the escapement factory.

The new electrical measurements laboratory at the Woolwich Polytechnic illuminated by Philips' lamps and fittings

Change of Address

The Brass and Copper Tube Association has removed to King Edward House, New Street, Birmingham (telephone: Midland 6,083).

Batti-Wallahs' Society

The monthly luncheon of the Batti-Wallahs took place at the Hotel Victoria on Tuesday, with the president, Col. Sir T. F. Purves, in the chair. The principal guest was Mr. A. Beverley Baxter, M.P., the well-known journalist, who delivered an entertaining address on personalities in Parliament. Mr. P. V. Hunter proposed the vote of thanks.

African Cables Deal

The *Financial Times* reports that control of African Cables has been acquired by the Cable Makers' Association, the Association having bought 156,000 £1 ordinary shares (60 per cent. of the capital) of African Cables at £1 19s. per share. Formed early in 1936, African Cables erected a factory at Vereeniging, near Johannesburg, which commenced the production of light cables nine months ago. An expansion programme, aimed at supplying the Union's full requirements, was commenced. The new plant will be completed within the next three months. Our contemporary states that it is unlikely, in view of the new financial developments, that plans for the expansion of production will be proceeded with.

The Plastics Year Book

The 1938 edition of the "British Plastics Year Book, 1938" (Plastics Press, Ltd., price 15s. net), which has just been published, is a useful handbook and guide to the plastics industry. The same arrangement of sections as in previous years has been retained, but with the increase of some of the sections it has been found necessary to limit the space devoted to the editorial section in order to keep the volume within reasonable bounds. The "Who's Who" section has been nearly doubled, and other sections which have been enlarged are proprietary names and manufactured products. The development of cast resins in this country has made considerable progress during the past year, and some details of the process and methods of manipulation have been included.

Position of the Canadian Radio Industry

The Minister of Finance has asked the Canadian Tariff Board to make a complete investigation of the radio-receiver manufacturing industry. The investigation will embrace the production, distribution, and sale of receiving sets, valves, and component parts, and will include a review of the effect of the patent law upon the manufacture, use, and importation of radio valves and sets, particularly the effect upon the importation, cost, and use of radio sets in Canada.

New Premises for Norwich Electricity Department

The Norwich City Council has adopted a scheme of the Electricity Committee for new electricity stores, workshops, offices and display windows in Duke Street at a cost of £74,890.

A Brave Admission

The supremacy of electricity for efficient office lighting has long been recognised, but it is interesting to learn that one of its chief competitors, the Gas Light and Coke Co., has seen the wisdom of adopting this form of illumination. We are informed that the company is now using a large number of "Typerlite" local lighting units with its many mechanised office appliances.

Woolwich Polytechnic Lighting

Following the satisfactory use of Philips lighting fittings at other parts of the Woolwich Polytechnic they have again been chosen for the recently opened extension comprising three laboratories, three workshops and two staff rooms. Two of the workshops and one of the laboratories are below ground level, and in view of the limited head-room "DB 26" fittings housing 100-W lamps have been placed as close to the ceiling as possible by means of special mountings, combining a bronze-finished gallery with a bronze-finished back-plate to fit a standard box. The fittings used in the remaining rooms are of the standard "DB 33" pattern, the only deviations from standard being a modification in the method of the D-type suspensions. Each of these fittings encloses a 200-W lamp. The average illumination over the working plane is 11-13 ft.-candles, and local lighting of blackboards, with its attendant specular reflections and "high lights," has proved unnecessary. The installation, which was carried out by Drake and Gorham, Ltd., to the specification of Mr. E. L. Sainsbury, of the Polytechnic Electrical Engineering Department, required fifty-nine "DB 26" and 127 "DB 33" fittings. This brings the total number of Philips fittings installed at the Polytechnic to 389.

New Catalogues and Lists

Foster Engineering Co., Ltd., Apex Works, South Wimbledon, London, S.W.19.—A 52-page illustrated art catalogue dealing with switch- and fuse-gear and air-cooled bell and low-voltage transformers.

London Electrical Co., Ltd., 1, Sherborne Lane, King William Street, London, E.C.4.—A 196-page catalogue, fully illustrated and bound in book form, has been issued. It covers electrical supplies with the exception of radio and domestic appliances.

British Aluminium Co., Ltd., Adelaide House, King William Street, London, E.C.4.—Technical booklets dealing with aluminium alloy, sheet and sections and ingots and billets.

Chloride Electrical Co., Ltd., 137, Victoria Street, London, S.W.1.—Wiring for emergency lighting is described with technical diagrams in a new booklet.

Wilkins & Wright, Ltd., Utility Works, Holyhead Road, Birmingham, 21.—A 40-page catalogue of electrical and general metalware.

Union Lamp & Lighting Co., Ltd., Union Lamp Works, Abbeydale Road, Wembley.—A leaflet illustrating "Union" tubular opal candle lamps.

J. Gerber & Co., Ltd., 23A, White Street, London, E.C.2.—"The Machinery Directory" is the title of a catalogue of second-hand, reconditioned and new electrical equipment of all kinds.

Drake & Gorham Wholesale, Ltd., 77, Long Acre, London, W.C.2.—An illustrated catalogue of vacuum cleaners and floor polishers.

Sun Electrical Co., Ltd., 118, Charing Cross Road, London, W.C.2.—A catalogue of "Propelair" fans of all kinds and a pocket price card for "Sunco" motors.

Metropolitan Pipe & Pole Co., Ltd., 1, Buckingham Palace Gardens, London, S.W.1.—An illustrated art catalogue of concrete lighting and floodlighting standards.

Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.4.—A catalogue of pneumatic tubes for the transmission of messages.

Bankruptcy Proceedings

F. H. Steiner, trading as Hants Electrical Utilities Co. (a firm), 6b, Northam Road, Southampton, dealer in household electrical necessities.—The public examination was held at the Court House, Castle Square, Southampton, on March 16th, and in reply to the Official Receiver debtor said that she was the registered owner of the business, but the premises at Northam were in the name of her husband, and he was the manager of the business. A loss of £250 had been sustained on a branch business at Southsea, and two other shops opened at Aldershot and Farnborough had also proved unsuccessful. Debtor told the Court that she knew nothing about the trading figures. It appeared that the business had declined owing to competition and the difficulty of financing hire-purchase agreements.

The deficiency amounted to £888. The examination was adjourned.

E. Nelson, trading as Elizabeth Nelson & Son, 63, Wharton Street, South Shields, electrician.—The public examination was to have been held at the County Court, John Street, Sunderland, on March 17th, but it was stated that debtor was ill and could not appear. According to the statement of affairs returned there was a deficiency of £951 on ranking liabilities of £1,067. The failure was attributed to losses on contracts through under-estimating and lack of capital. The examination was adjourned.

G. F. D. Leech, "Neon," Plumstead Road, Thorpe St. Andrew, Norfolk, lately carrying on business at Cleveland, Oulton Road, Lowestoft, electrician.—The public examination was held at the Shirehall, Norwich, on March 15th. The statement of affairs disclosed ranking liabilities of £274 and a similar deficiency. Debtor attributed his failure to losses on contracts and shortage of capital. The examination was closed.

A. C. E. Applin, carrying on business under the style of "Applin and Burt," 110, St. Mary's Road, Southampton, electrical engineer.—Debtor applied for his discharge on March 15th at the Court House, Castle Square, Southampton. The receiving order had been made in 1931, and the liabilities amounted to rather more than £1,000. The discharge was granted subject to six months' suspension.

G. W. Jump, 143, Sussex Road, Southport, electrical engineer. —The public examination was held on March 15th at the Court House, Government Buildings, Victoria Street, Liverpool, the debtor's statement of affairs showing liabilities of £142, against assets of £34, leaving a deficiency of £108. The debtor attributed his failure to inability to recover moneys due to him for work done. The examination was closed. Last day for receiving proofs for dividend April 2nd. Trustee, Mr. J. Allcorn, Government Buildings, Victoria Street, Liverpool.

W. J. Fishbourne, 7, Tynewydd Terrace, Newbridge, Mon, electrical and mechanical engineer and radio dealer.—The public examination was resumed recently at the Town Hall, Newport (Mon). Debtor attributed his failure to inability to collect book debts and insufficient work. His statement of affairs showed unsecured liabilities of £233 and a deficiency of £121. The examination was closed.

A. M. Gibson and **W. R. F. Gibson** (Gibsons Wireless), radio specialists, 94, Tavistock Road, Plymouth, and at Exmouth and Teignmouth (separate estate of W. R. F. Gibson).—Last day for receiving proofs for dividend April 2nd. Trustee, Mr. A. N. F. Goodman, 11, St. Aubyn Street, Devonport, Plymouth.

R. Robinson, electrical engineer, The Arcade, Waterfoot, Lancs.—Last day for receiving proofs for dividend April 2nd. Trustee, Mr. P. M. Milward, Byrom Street, Manchester, 3. Official Receiver.

A. F. A. Webb, electrician, Ashdown, Regents Road, and formerly trading at 102, Duke Street, St. Helens.—Receiving order and order of adjudication dated anuary 6th, 1926, annulled, debts having been paid in full.

H. N. Wicks (H. Wicks & Co.), electrical specialist, Railway Hotel Buildings, Greenhithe, and at 8, Stone Street, Gravesend. —Discharge granted subject to debtor's consenting to judgment for £25 being entered against him by the Official Receiver.

Company Liquidations

Warner's Radio & Electric, Ltd., Leonard Street, E.C., and branches.—A further meeting of creditors was held on March 16th at Winchester House, Old Broad Street, London, E.C. According to the approximate statement of affairs the ranking liabilities were £80,356. The assets totalled £312,664 and they were estimated to realise £171,062. From the latter amount had to be deducted £23,102 for preferential claims, leaving net assets of £147,959, or a surplus, so far as the creditors were concerned, of £67,604. The issued capital of the company was £175,000, all fully paid, and as regarded the shareholders there was a deficiency of £107,396. Col. C. F. Hitchins, the chairman of the company, who presided, said it would be remembered that the creditors had previously met, but owing to a technical irregularity no effective resolution for voluntary liquidation was passed by the shareholders. The latter had, however, met again and a resolution for the voluntary liquidation of the company had been effectively passed. The voluntary liquidation of the company was confirmed, with Mr. C. Latham, 185-188, High Holborn, London, W.C., and Mr. F. W. le B. Lean, of Viney Price & Goodyear, Empire House, St. Martin's-le-Grand, London, E.C., as joint liquidators. A committee was also appointed.

Ray Electric, Ltd., Lancaster, wireless and electrical dealers. —The statutory meeting of creditors was held recently at the offices of C. Latham & Co., 185-188, High Holborn, London, W.C., when a statement of affairs as at March 10th last showed liabilities of £5,002. The net assets were £1,686, leaving a deficiency, so far as the creditors were concerned, of £3.316. The creditors passed a resolution in favour of the voluntary liquidation of the company being confirmed, with Mr. C. Latham and Mr. Howarth, of Lancaster, as joint liquidators. A committee was also appointed.

Western Electricity Supply Co., Ltd.—Winding up voluntarily. Liquidator, Mr. E. J. Harrison, 11, Waterloo Place, S.W.1. Particulars of claims to the liquidator by April 11th.

Electrical Instruments (Leeds), Ltd.—Meeting April 25th at Orchard Chambers, Church Street, Sheffield, to receive an account of the winding up by the liquidator, Mr. A. W. Macredie.

Yorkshire Electrical Sales & Service, Ltd.—Meetings April 19th at 19, Quay Road, Bridlington, to receive an account of the winding up by the liquidator, Mr. C. A. Wood.

Dissolution of Partnerships

Shaw Bros., wireless engineers and electricians, 96, Highcross Street, Leicester.—Messrs. G. F. and J. E. Shaw have dissolved partnership. Mr. J. E. Shaw will attend to debts and carry on the business.

Central Wireless Co., wireless dealers, 52, Standishgate, Wigan, and 787, Ormskirk Road, Pemberton, Wigan.—Mr. J. Tilley and Florence Taylor have dissolved partnership. Mr. Tilley will attend to debts and carry on the business.

Electricity Supply

Lighting, Domestic, Power

Argentina.—GOVERNMENT ORDERS REDUCTION IN CHARGES.—On February 11th the Government of the Province of Córdoba issued a decree ordaining that the tariffs of the Compañía General de Electricidad should be reduced by 20 per cent. of the basic prices specified in its contract law over its whole system. The decree states that this is a provisional measure, taken without prejudice to a later revision of the tariffs. In the meantime the company is not allowed to charge more than 27.24 and 7.26 centavos per kWh for light and power, respectively.—*Review of the River Plate.*

Ashford (Kent).—DEPARTMENT'S ACCOUNTS.—The 1936-37 abstract of accounts of the Electricity Department (engineer, Mr. H. Wilson) shows that revenue increased from £62,076 to £68,752, and working costs from £40,205 to £42,762, there being a net profit of £2,173 against a loss of £936 in the previous year. Sales increased by 15 per cent. to 13.2 million kWh, the consumption per head of the population rising from 334 to 383 kWh and the number of consumers from 8,110 to 8,697. The average price obtained per kWh sold was 1.254d. (against 1.304d.).

Atherton (Lancs).—ELECTRICITY CHEAPER.—The price of electricity supplied through prepayment meters is to be reduced from 4d. to 3½d. per kWh, and through quarterly meters from 3¾d. to 3¼d. per kWh. The two-part tariff for private houses will be reduced to 10 per cent. of the rateable value per annum, and ¾d. per kWh for all electricity used. The revision will benefit consumers by £1,700 in a year.

A "floral" display in connection with Selfridge's twenty-ninth birthday celebrations. A striking effect is produced by the changing colours of the "tulips" [*Elec. Rev. photo.*

Australia.—PERIODICAL INSPECTIONS.—The Sydney County Council Electricity Department has informed electrical contractors in its area that, in accordance with an Ordinance which will shortly be published, it will periodically inspect each of the installations connected to its mains. These inspections will include domestic, commercial and industrial installations. If the inspections reveal defects the consumers will be required to have these rectified by licensed electrical contractors.

EARTH-LEAKAGE PROTECTION.—Earth-leakage switches will be required on every installation carried out in Victoria on or after April 4th next and also in certain cases where an installation is altered.

Barrow-in-Furness.—CHANGE-OVER SCHEME.—The Electricity Committee is to proceed with a change-over from d.c. to a.c. in the Oxford Street area at a cost of £15,000.

EXTENSIONS.—Overhead lines are to be erected at an estimated cost of £906 for the supply to Bouth, Colton and Oxen Park.

Bedford.—ILLUMINATIONS.—The riverside and the embankment flower gardens are to be illuminated during the summer at a cost of £250.

SUPPLY TO ESTATE.—The Electricity Committee is to extend its mains at a cost of £2,670 to supply the Jene's estate, Harrowden Road.

Blackpool.—LOWER CHARGES.—Reductions in electricity charges have been brought into effect. The m.d. tariff for lighting is reduced from 6d. and 1½d. to 6d. and 1d., and the m.d. power tariff from 3d. and ¾d. to 3d. and ½d. The reductions chiefly affect shops, hotels, and other long-hour consumers.

Burnley.—RURAL SUPPLIES.—It is proposed to carry out extensions as follows: Farside, Cliviger; overhead and underground cables. Brownside to Worsthorne, underground cable. Ennerdale Road, Worsthorne, to sewage works, underground

cable. Dunnockshaw—Springfield House, overhead cable, subject to concurrence of the Lancashire County Council.

CONTRIBUTION TO RATES.—The Corporation has decided to transfer £5,000 from the electricity and £11,000 from the tramway and omnibus profits towards the relief of the district rates.

Croydon.—LOANS.—The Electricity Committee has obtained sanction to borrow £36,317 for the ring main scheme and £22,757 for mains extensions, and is seeking sanction to borrow £15,000 for rental wiring installations.

Darlington.—SUB-STATIONS.—The Town Council proposes to erect sub-stations in Hurworth Place, Croft, Carmel Road and West Street.

Dartford.—CABLES.—The Electricity Committee is to provide an interconnecting link between the a.c. cables in Brent Lane and East Hill, at a cost of £526. It is also to link the St. Vincents Road sub-station with the reservoir kiosk and change the existing d.c. supply to a.c. at a cost of £1,006.

Dorset.—RURAL SUPPLY DIFFICULTIES.—Wayleave difficulties have arisen in connection with the Weymouth Corporation's proposal to afford supplies to Abbotsbury, Portisham, Littlebredy, Winterborne Abbas, Winterborne Steepleton and Winterborne St. Martin. The Dorchester Rural District Council has offered to give as much help as possible, an offer which also applies to proposed supplies to Fleet, Langton Herring, West Stafford, Whitcombe, Bincombe, Winterborne Came and Winterborne Herringston. Further difficulties have arisen by reason of the Strangeways Estates objecting to the placing of the lines on the route to Portisham and Abbotsbury. They are to be informed that unless the objection is withdrawn no supply can be given.

Glasgow.—COOKING IN MUNICIPAL HOUSES.—A joint sub-committee of the Corporation Housing and Electricity Committees has reported on the charges made in respect of the removal of cookers provided by the Housing Department in Corporation houses and for the provision of adequate mains. The recommendations include the following:—That the Housing Department shall reinforce at its own expense the main cables between the Electricity Department's supply terminals and the meters in houses where application is made by consumers for installation of electrical appliances; that in the case of newly constructed houses the tenant shall be given an opportunity of stating whether he would prefer a standard gas cooker or an electric cooker from the Electricity Department on the usual hire or hire-purchase terms; and that in the case of houses in which gas cookers have already been installed consent to the removal of the cooker shall not be granted unless the tenant undertakes to make a payment to the Housing Department in addition to the usual installation and hire charges of the Electricity Department.

Guisborough.—BETTER LIGHTING.—The casting vote of the chairman brought about the abandonment of a resolution, already approved, that the Council should give up a £460 public lighting scheme. It was also suggested that application should be made for permission to borrow £1,000 for street lighting in villages in the area.

Hornsey.—CHEAPER DOMESTIC ELECTRICITY.—At last Monday's meeting of the Borough Council approval was given to a proposal that the running charge of the domestic "all in" contract tariff should be reduced from 2 to 2½ kWh a penny.

Hull.—ELECTRICITY FOR FAIR GROUND.—The Showmen's Guild has approved a scheme prepared by the city electrical engineer for supplying electricity for power and lighting on the Walton Street fair ground. The cost is estimated at between £5,000 and £6,000, and tenants of all sites (except riding machines whose proprietors will generate their own supply) will take the supply from the Corporation.

Leeds.—NEW EQUIPMENT.—Contracts amounting to £80,000 have been placed for new switchgear and transformers for extensions to the Whitehall Road power station.

London.—ISLINGTON.—The borough electrical engineer has submitted a scheme for the transfer of four banks of Scott-connected transformers from the turbine house to a site which had been reserved for switchgear. The scheme provides for the erection on stanchions of a building over the yard in which to install the transformers and ancillary apparatus. It is estimated that the total cost of the scheme will amount to £24,500.

The following estimated capital expenditure for three years has been approved:—Low-voltage distributor mains, high-voltage mains, short length extensions and services, £100,787; transformers, £20,000; meters and time switches, £63,089; rental wiring, £60,000; sale and hire-purchase of apparatus, £17,500; hire of aparatus, £29,650.

HACKNEY.—As it has been unable to secure sites for two transformer sub-stations urgently needed in the De Beauvoir district the Electricity Committee is to proceed by way of compulsory purchase orders.

The Committee is of the opinion that the provisions of the Coal Bill relating to appeals to Committees of Investigation do not afford sufficient protection to public utility undertakings as regards price regulation, and recommends that representations shall be made to the Members of Parliament for the borough urging them to use their endeavours to secure adequate statutory safeguards to control the price of coal to such undertakings.

HAMMERSMITH.—The arrangement with electrical contractors for the execution of work under the assisted-wiring scheme is to be terminated on April 30th, the Council having decided to do the work itself.

ST. PANCRAS.—The lighting of Gower Street and Judd Street is to be improved by the installation of electric-discharge lamps. The cost will be £1,561 and the illumination will be increased three and a half times.

STOKE NEWINGTON.—It is proposed to include a minimum quarterly charge of 7s. 6d. in the terms of the No. 2 rate for lighting and all general purposes (fixed charge of £2 10s. per kVA of lighting installed or demanded per quarter and ¾d. per kWh). At the Council meeting on Tuesday it was moved that the Electricity Committee should give early consideration to the desirability of reducing the charges under Scale 1 as follows: (a) Prepayment meters, from 4½d. to 4d. per kWh with own wiring, and from 6d. to 5½d. per kWh with assisted wiring; (b) quarterly meters, from 4½d. to 4d. per kWh. The proposal was lost on a vote, but it was indicated that the Committee would give sympathetic consideration to the possibility of making some concession.

Middlesbrough.—DISTRIBUTION IMPROVEMENTS.—The Town Council proposes to carry out improvements to the distribution system in Cumberland Road and Bishopton Road at a cost of about £7,500.

Northern Rhodesia.—NEW POWER STATION.—On March 16th the Governor of Northern Rhodesia (Major Sir Hubert Young) pressed a switch to start up a new hydro-electric power station built by the Transvaal Power Co. at the Victoria Falls. According to *The Times* the station in no way detracts from the natural beauty of the Falls, as it is situated at the bottom of a deep gorge.

Oldham.—DOMESTIC APPLIANCES ON HIRE.—It was recently reported to the Electricity Committee that there were now more than 3,000 cookers on simple hire, in addition to the number purchased outright and on hire-purchase. Well over 2,000 wash-boilers were hired and many more had been purchased privately or were on hire-purchase. Vacuum cleaners were often sold at the rate of fifty a week.

Paisley.—FLOODLIGHTING.—The Electricity Advisory Committee recommends that the electrical engineer shall make provision for permanent fittings for the floodlighting of the Abbey and the Town Hall. The engineer is to prepare a report on a scheme for improved lighting at Dunn Square.

Renfrew.—GAS COMMITTEE CONSIDERS ELECTRIC LIGHTING.—At a recent meeting of the Town Council the Gas Committee, having considered the electric lighting of the principal streets in the town, recommended that particulars of cost of installation, upkeep, &c., should be investigated. It was explained that air-raid precautions led the Committee to consider electricity for street lighting.

Repton.—RURAL SUPPLIES.—The Derbyshire and Nottinghamshire Electric Power Co. proposes to afford a supply of electricity to parishes in the Repton and Shardlow Rural District Council's area.

Bomb-proofing Power Stations

THE construction of a bomb-proof power station was discussed in a paper by Mr. A. J. Hodgkinson (chief draughtsman to the Yorkshire Electric Power Co.) at a meeting of the Yorkshire branch of the INSTITUTE OF STRUCTURAL ENGINEERS at Leeds last week. One had, he said, to consider an attack by aeroplanes flying at 200-300 miles per hour at a height of 20,000 ft. and carrying bombs of from 2 lb. to 2,000 lb. To resist a heavy high-explosive bomb it was stated that 15 ft. thick concrete would be necessary. At a height of 20,000 ft. it would be necessary to release the bomb about 3,000 ft. before the objective, and with a large bomb many more misses than hits could be expected. It was necessary, however, to design a structure to resist a direct hit, or, alternatively, to design the service in duplicate, or in sections so that it could be maintained with a section destroyed. The best place for protection was below the ground level, the deeper the better, but to construct a power station below the ground would be very costly and impracticable. A first consideration should be to parry the bomb forces, and so keep out of the structure the destructive internal forces of the bomb. Secondly, should the bomb penetrate the structure there should be a second line of defence against destruction of the place. For this purpose reinforced concrete was an excellent material.

Alluding to a suggested design of a reinforced concrete structure, he said it was cone-shaped, with outer and inner shells of reinforced concrete, to house the plant and equipment. The plant would be designed in harmony with the structure, as in the case of a power plant in a ship. Such a type of structure had further advantages apart from bomb resistance, for the space between the shells provided an excellent air passage for the circulation of the vast quantity of air required for the boiler furnaces.

Rotherham.—ELECTRIC KILN IN SCHOOL.—An electric kiln has been installed in the pottery section of the Rotherham School of Art.

Saddleworth.—TERMS "UNREASONABLE."—A complaint that the Stalybridge, Hyde, Mossley and Dukinfield Transport and Electricity Board wanted an "unreasonable" sum for an extension was discussed at a recent meeting of the Lighting Committee. The house owner stated that the Board's terms would be £5 and a guarantee to use £10 worth of electricity per year for three years. The surveyor said that 370 yd. of overhead line and eight poles would be needed to reach the property, which was on the extreme edge of the Saddleworth area. It was decided to ask the Board to give the service requested, and that if it refused the Council should approach the Electricity Commissioners.

Salisbury.—RURAL SUPPLIES.—The Wessex Electricity Co. is extending its supply to Pitton and Farley.

Shilbottle (Northumberland).—STREET LIGHTING PLEBISCITE.—At a recent poll to decide whether street lighting should be introduced there were 105 votes in favour and 69 against, but as this does not constitute a two-thirds majority no action can be taken.

Stockton-on-Tees.—SUB-STATIONS.—The Town Council is to erect a sub-station in Oxbridge Avenue, and alterations and improvements are proposed to sub-stations in the Yarm Lane area, including switchgear and transformers, at a total cost of £4,950.

MAINS.—A.c. mains are to be laid in Garbutt Street at a cost of £330.

Stoke-on-Trent.—SUB-STATION.—The Town Council proposes to erect a sub-station in Rectory Street, Shelton, at an estimated cost of £5,000.

Sunderland.—CHEAPER LIGHTING.—The Electricity Committee has agreed to a reduction in the charges made to the Highways Committee for street lighting.

Sutton-at-Hone (Kent).—OVERHEAD SUPPLY.—Objection has been raised by the Parish Council to the overhead lines to be used by the West Kent Electric Supply Co. for a supply to the village, but as the introduction of electricity depends upon their use the Council has waived its objection for the time being.

Swansea.—TURBINE BREAKDOWN.—In reply to a question by Councillor Mainwaring Hughes at a meeting of the Council last week the borough electrical engineer (Mr. J. W. Burr) said that the breakdown of a turbine at the Tir John power station recently was of a kind that was likely to take place at any generating station and had nothing to do with the high pressure. The Corporation was covered by insurance on all claims over £1,000, but he could not say what the cost of the present repairs would be.

ADMINISTRATION OF UNDERTAKING.—The Council agreed to the appointment of a Special Committee of nine to investigate the administration of the whole undertaking. During the discussion it was urged that there should be no members of the Electricity Committee upon the Special Committee on the ground that it should be an impartial inquiry. Other members pointed out that the Committee was not intended to be an inquisition. The Council decided that members of the Electricity Committee should be included.

Taunton.—DEPARTMENT'S PROGRESS.—The Council's accounts for the year ended March 31st last show that the revenue of the Electricity Department (engineer, Mr. L. V. Turner) was £78,850, against £54,397 in the previous year, and expenditure £69,001 (£50,879), giving a surplus of £9,849 (£3,516). Sales increased by 25 per cent. to 9.2 million kWh. New connections totalled 2,496 kW, and this is the net increase as no disconnections are shown. Consumers increased in number from 6,782 to 7,598. On July 1st, 1936, the Department's power station came under the grid scheme.

Torquay.—METERS AND INSTRUMENTS.—The Electricity Committee is seeking sanction to borrow £4,000 for meters and instruments.

Tynemouth.—SUB-STATION.—A sub-station is to be erected in Preston Road at a cost of £1,500.

Weymouth.—RATE CONTRIBUTION NOT LEGAL.—The Electricity Committee has informed the Town Council that the proposed transfer of £3,000 from the electricity profits to the rates cannot legally be effected. The Committee therefore recommended that the sum of £8,512 (a portion of the balance of the net profit, and of which the £3,000 referred to forms part) should be allocated to the reserve fund, and that for the year which commenced on April 1st last, the charges for street lighting should be reduced from 1¾d. to ¾d. per kWh, thereby reducing the amount payable by the Street and Works Committee for the year by approximately £1,260.

Wigan.—LOANS.—The Town Council is applying for permission to borrow £7,500 for domestic apparatus and £2,800 for a switchboard.

Traction

Ashton-under-Lyne.—TROLLEY-BUSES DOUBLE RECEIPTS.—The chairman of the Transport Committee (Councillor W. L. Connery) stated at a recent meeting of the Council that the introduction of trolley-buses had doubled the revenue. Alderman J. Broadbent said he felt that everyone in the town would be delighted with the smooth running of the vehicles.

London.—NEW TUBE TRAINS.—On Monday the London Passenger Transport Board placed orders for new Tube rolling stock to the value of nearly £9 million. The number of cars now on order is 1,567, with a total carrying capacity of 220,000 passengers.

Newcastle-on-Tyne.—NEW TROLLEY-BUS ROUTES.—Trolley-buses are to be introduced on the routes from the Osborne Road and Fenham termini to the central station. Tramcars are at present covering these routes and will continue in operation for a time after trolley-buses have been started.

Southern Railway.—TRIAL RUNS ON NEWLY ELECTRIFIED LINE.—Trial runs have begun over the newly electrified portions of the Southern Railway between Ford and Fratton, including Bognor Regis. Both the type of train that will be used for local services and that for longer journeys have been tried and proved satisfactory. It is expected that the electrified services will start in July.

South Shields.—CONVERSION NEARLY COMPLETED.—By about the middle of next month only one tram route will be left in the South Shields area, the remainder having been converted to trolley-buses. The Corporation has at present twenty trolley-buses and the number will be increased to thirty-two. It is expected that the Ridgeway-Moon Street tramway will continue in operation for at least another five years.

Sunderland.—BATTERY TOWER WAGON.—The Town Council has decided to purchase an electric battery tower wagon at an estimated cost of £725.

Switzerland.—HIGHEST CABLE RAILWAY IN THE WORLD.—The Aiguille du Midi cable railway, the first to be built in France for the use of travellers, was carried to an altitude of 2,431 metres in 1927 to the point called Les Glaciers. It has now been decided to carry the railway still higher up to the Col du Midi, making a total height of 3,625 metres. When completed it will be the highest cable railway in the world, states *Reuter's Trade Service* (Paris). It is only possible to work at this altitude between June and October, and it will be at least two summers before the extension is completed. The plans for the line have already been decided upon and work will be commenced this summer. The first step will be to stretch a cable between the two points, establishing a line of communication for the transport of the workers and materials. The first light rope, forming the basis of the cable, will probably be carried by a 'plane and unrolled along the Col du Midi.

Forthcoming Events

Institution of Electrical Engineers.—Monday, March 28th. Institution, London, W.C.2. 7 p.m. Informal meeting. Discussion on "Engineering Economics in Planning." To be opened by Mr. F. Gill.

Wireless Section.—Wednesday, March 30th. Institution, London, W.C.2. 6 p.m. "High-power Valves." Messrs. J. Bell, J. W. Davies and B. S. Gossling.

Meter and Instrument Section.—Friday, April 1st. Institution, London, W.C.2. 7 p.m. "Some Polarisation Phenomena in Magnetic Materials, with Special Reference to Nickel-Iron Alloys." Mr. T. A. Ledward. "The Use of Auxiliary Current-Transformers for Extending the Range of Metering Equipment." Mr. G. F. Shotter.

Tees-side Sub-Centre.—Friday, March 25th. Grand Hotel, Middlesbrough. Annual dinner.

North-Eastern Centre.—Monday, March 28th. King's College, Newcastle-on-Tyne. 6.15 p.m. "Recent Progress in Power Rectifiers and their Applications." Mr. W. G. Thompson.

Western Centre.—Monday, March 28th. Newport. Cooker papers by Messrs. O. W. Humphreys and J. N. Waite.

North Midland Centre.—Tuesday, March 29th. Hotel Metropole, Leeds. 7 p.m. Annual general meeting.

North-Western Centre.—Tuesday, March 29th. Engineers' Club, Manchester. 7.15 p.m. "Safeguards against Interruptions of Supply." Messrs. H. W. Clothier, B. H. Leeson and H. Leyburn.

West Wales (Swansea) Sub-Centre.—Thursday, March 31st. Grand Hotel, Swansea. Dinner. Discussion on "Electricity Regulations in the Factory Acts."

Physical Society.—Friday, March 25th. Imperial College of Science and Technology, South Kensington, London, S.W.7. 5.15 p.m. Short papers.

Electrical Power Engineers' Association (*London Local Group*).—Saturday, March 26th. Café Royal, Regent Street, London, W.1. 6.30 p.m. Annual dinner and dance.

Kent Section.—Saturday, April 2nd. Royal Star Hotel, Maidstone. 6 for 6.30 p.m. Annual dinner and dance.

Birmingham Electric Club.—Monday, March 28th. Grand Hotel, Birmingham. 7 p.m. "Television." Mr. G. H. Watson.

Rugby Engineering Society.—Wednesday, March 30th. New Big School, Rugby. 7.30 p.m. "The Interruption of Current." Mr. K. J. R. Wilkinson.

Institute of Fuel.—Thursday, March 31st. Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1. 6 p.m. Joint meeting with the Institution of Heating and Ventilating Engineers. "A Comparison of the Cost of Heat Supply by Electrode Boiler and by Coke Boiler to the same group of Buildings." Mr. S. Livingstone Smith and Prof. C. H. Lander.

Institute of Metals.—Thursday, March 31st. 83, Pall Mall, London, S.W.1. Annual general meeting.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aberdeen.—March 31st. Education Committee. Electric lighting for Ellon Secondary School. Director of Education, 22, Union Terrace.

Aldershot.—April 5th. Electricity Department. Cable and meters for twelve months. (March 11th.)

Australia.—MELBOURNE.—April 4th. City Council. 530 electricity meters. (T.Y. 18853/38.)*

Ayr.—March 28th. County Council. Electrical work at new school at Braehead, and Nursery school at Dalry. County architect, County Buildings.

Bootle.—April 4th. Watch Committee. Sodium electric lighting for Southport Road. (March 11th.)

Brecknockshire.—April 1st. Electric lighting and heating installation at new senior school at Crickhowell. H. C. W. Strickland, Watton Offices, Brecon.

Bridlington.—April 2nd. Town Council. 11-kV switchgear equipment, l.v., a.c. distribution panel and one 500-kVA transformer. (March 18th.)

Dartford.—March 26th. Borough Council. 1,375 yd. of 11-kV cable. (March 18th.)

Dundee.—April 6th. Electricity Department. Electric cookers, wash boilers, water heaters, a.c. meters and d.p. switches for one year. (March 18th.)

Egypt.—CAIRO.—April 2nd. Ministry of Public Works. Electrical and pumping plant, travelling cranes, lorries, cables, &c., for Mecca water and power scheme. (T.Y. 18398/38.)*

Fife.—March 28th. County Council. Electric lighting installations in twenty houses at Freuchie. County Clerk, Cupar (deposit £1 1s.).

Gellygaer (GLAM.).—April 2nd. Electricity Department. One electric battery vehicle and one petrol-driven vehicle. (March 18th.)

Great Ouseburn (YORKS).—March 25th. R.D.C. Pumping machinery, including electric motor and automatic switchgear for three pumping stations at Nether Poppleton. Clerk of the Council, Council Offices, Boroughbridge, Yorks (deposit £5).

Hazel Grove and Bramhall.—March 31st. Electricity Department. E.h.v. and l.v. switchgear and booster equipment. (March 18th.)

Heston and Isleworth.—April 2nd. Electricity Department. One 600-kVA transformer, e.h.v. switchgear, milking booster, and special l.v. testing transformer. (March 18th.)

Horsham.—March 26th. Electricity Department. Meter-testing equipment and three 300-kVA, three-phase, oil-cooled transformers. (March 11th.)

Hull.—April 1st. Electricity Department. One thirty-ton weighbridge. (March 18th.)

Iraq.—April 2nd. Government. Four Diesel engines coupled direct to a.c. generators, with all accessories. Royal Iraq Legation, 22, Queen's Gate, London, S.W.7.

Kent.—The County Education Committee invites applications from contractors for the addition of their names to its list of contractors for electrical installation work. (See this issue.)

Kirriemuir.—Equitable Co-operative Society. Electric lighting and heating installations at new shops. Scottish Co-operative Society, Ltd., Architectural Department, 119, Paisley Road, Glasgow.

Littleborough.—April 9th. U.D.C. Four sets of electrically driven, vertical, unchokeable centrifugal sewage pumps, including automatic starters, switchboard and wiring. Clerk to the Council, Council Offices (deposit £2).

London.—ST. MARYLEBONE.—March 29th. Electricity Department. Work in connection with the laying of stoneware ducts and the drawing-in and jointing of h.v. cables in streets. (March 18th.)

ISLINGTON.—April 1st. Borough Council. One 200-ft. electrically driven belt conveyor. Cleansing Superintendent, Liverpool Road.

Manchester.—March 25th. Electricity Committee. Cables and service cut-outs for twelve months. (March 11th.)

March 31st. Electricity Department. Static transformers for twelve months.

April 20th. Coal-dust collecting plant for Barton power station. (March 18th.)

Mansfield.—April 12th. Meden Valley Waterworks Committee. One 460-kVA three-phase transformer for Budby pumping station and one 125-kVA three-phase transformer, e.h.v. switchboard, and m.v. switchboard for Stoney Houghton pumping station. (March 18th.)

Middlesex.—April 11th. County Council. Two X-ray units and equipment for the Redhill County Hospital. (March 18th.)

Newport.—April 21st. Electricity Department. Two water-tube boilers and accessories. (March 18th.)

New Zealand.—WELLINGTON.—May 4th. Posts and Telegraph Department. Telephone cable. (T.Y. 18645/38.)*

April 20th. 100 batteries. (T. 18643/38.)*

April 27th. 1,100 secondary cells. (T.Y. 19186/38.)*

April 12th. Public Works Department. 11,000-V, 400-V multicore, and telephone cable. (T. 19185/38.)*

June 28th. Public Works Tenders Board. Nine 110-kV single-phase potential transformers and accessories, and nine auxiliary transformers. (T.Y. 19187/38.)*

Portsmouth.—April 11th. Electricity Undertaking. Meter-testing equipment. (March 18th.)

April 19th. E.h.v. and l.v. sub-station switchgear and steel kiosks with switchgear. (See this issue.)

Reigate.—April 1st. Electricity Department. Materials for twelve months. (March 18th.)

South Africa.—PRETORIA.—March 31st. Public Works Department. Two vertical discharge centrifugal sewage pumps and two high starting torque squirrel-cage motors. (T.Y. 18737/38.)* Thirty-four electric synchronous clocks. (T.Y. 18736/38.)*

CAPE TOWN.—April 20th. Electricity Department. House service electricity meters. (T. 19146/38.)*

JOHANNESBURG.—April 16th. City Council. Screwed electrical conduit for twelve months. (T.Y. 19504/38.)*

April 25th. Railways and Harbours Administration. One twenty-ton electric travelling crane. (T. 19507/38.)*

Straits Settlements.—SINGAPORE.—April 4th. Municipal Water Department. Three generating sets. (T.Y. 18864/38.)*

Swindon.—March 31st. Great Western Railway. Insulated v.i.r. cables, telegraph ironwork and lamps. (March 11th.)

April 12th. Electricity Department. One sheet steel kiosk sub-station with e.h.v. equipment. (See this issue.)

Uruguay.—MONTEVIDEO.—April 8th. Electricity Supply and Telephones Administration. Single, double and triple pole and rotary switches. (T.Y. 18880/38.)*

April 7th. Two electric lifts. (T.Y. 18879/38.)*

April 26th. 20,000 insulator bolts or pins. (T.Y. 19287/38.)*

April 20th. Insulators, sockets, lampholders, fuse plugs, transformers for bell installations, &c. (T.Y. 19284/38.)*

April 19th. 655 dynamometric type electricity meters. (T.Y 19282/38.)*

April 22nd. Electric motor-operated convertor set for electric welding. (T.Y. 19286/38.)*

Wakefield.—April 4th. West Riding Public Health and Housing Committee. Electrical work at the proposed child welfare clinic at Church Road, Denaby Main, near Conisborough. Clerk of the County Council, County Hall.

April 4th. County Council. Electrical installation at Ardwick-le-Street Grammar school, Castleford Senior school, and the extensions at North Elmsall Harewood Lane Council school. Clerk of the County Council, County Hall.

Wallasey.—April 19th. Borough Council. Single-phase (indoor and street-pit type) transformers. (See this issue.)

Ware.—April 2nd. U.D.C. Electric lighting installations in thirty-eight houses. (See this issue.)

Weymouth.—April 5th. Electricity Department. E.h.v. and l.v., p.i. l.c., and s.t.a. cable for one year. (March 18th.)

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Bedford.—Electricity Committee. Accepted. Transformer kiosk (£163).—Crompton Parkinson.

Brighton.—Electricity Committee. Accepted. V.i.r. cables (£361).—William Geipel & Co. Tungsten electric lamps for street lighting (£1,133).—J. Ismay & Sons.

Dundee. — Electricity Committee. Accepted. Cables.—Britannic Cable Co. (£261); Hogan & Wardrop (£242); A.C.E.C. (£4,032).

Clyde.—Lighthouses Trustees.—Accepted. Renewal of radio control installations for operating fog signals (£925).—Gambrell Radio Communication, Ltd.

Erith.—Metropolitan Water Board. Accepted. Two sets of electric pumps for waterworks (£572).—Harland Engineering Co.

Glasgow.—Health Committee. Accepted. Section pillars for Woodilee Mental Hospital (£177).—Henley's.

Transport Committee. Accepted. Magnetic coils.—Met.-Vick. Elect. Co. Cable.—Craigpark Electric Cable Co.

Hull.—Education Committee. Accepted. Rewiring at Sir Henry Cooper School (£338).—Napier & Wheeldon.

Leeds.—Electricity Committee. Recommended, 750,000-kVA switchgear for the inter-connection of Whitehall Road and Kirkstall power stations (£57,175).—Ferguson, Pailin. 500,000-kVA switchgear for Whitehall Road power station extension (£23,371).—English Electric Co.

London.—ISLINGTON.—Electricity Committee. Recommended for twelve months: Cookers.—Jackson Electric Stove Co.: British National Electrics; Hotpoint Electric Appliance Co.: Revo Electric: Belling & Co. Water heaters.—Heatrae; Santon. Washboilers.—Burco.

BATTERSEA.—Electricity Committee. Accepted. E.h.v. switchgear for High Trees, Nightingale Lane, and Spiers and Pond's Laundry transformer houses (£1,075).—J. G. Statter & Co. Ten feeder pillars (£459).—W. T. Henley's. Superheater tube repairs (£670).—Babcock & Wilcox. Recommended for twelve months. Electricity meters.—Chamberlain & Hookham; Ferranti. Service joint boxes and house service cut-outs.—Callender's. Disconnecting boxes.—Henley's. Joint box compound.—Dussek Bitumen & Taroleum. Electrical wires for installation work.—Stearn Electric Co. Copper wire.—Mersey Cable Works. Flexible wires and switchplugs.—Wm. White & Co. Steel sheathing and fixing clips.—Sloan Electrical Co. Wiring accessories, conduit and conduit fittings.—Mosers, Ltd. Switches.—J. A. Crabtree & Co. Insulating tape.—Henley's. Iron-clad

cut-outs and switchfuses, splitters, and cooker control units.—Foster Engineering Co. Cookers.—Jackson Electric Stove Co. Cookerettes.—Belling & Co. Water-heaters.—Heatrae. Immersion heaters.—Santon. Wash-boilers.—Brantford Bros. Irons.—Revo Electric Co. Kettles.—Bulpitt & Sons.

HAMMERSMITH.—Electricity Committee. Recommended. Meter-testing apparatus.—Everett, Edgcumbe & Co. (£445); Zenith Electric Co. (£697); Cambridge Instrument Co. (£96); British Sangamo Co. (£225); Alkium Storage Batteries (£57). Three 500-kVA transformers (£744).—Bonar Long & Co. Three-phase, 11,000-V, 150,000-kVA switchgear (£454).—A. Reyrolle & Co. (Wood Lane sub-station) (£1,340).—J. G. Statter & Co. (White City sub-station). Single-phase, 2,200-V, 50,000-kVA switchgear for White City sub-station and general sub-stations (£1,808).—Ferguson Pailin. Recommended for twelve months: Electrical accessories.—W. Maxwell & Co.; G.E.C.; "Z" Electric Lamp & Supplies. Insulated wires.—Edison Swan Electric Co. House service cut-outs.—Siemens Electric Lamp & Supplies. Cable sockets.—Henley's. Meters.—Aron Electricity Meter. Meter seals.—Measurement. Meter boards.—B.I. Cables. Insulating compound.—Dussek Bitumen & Taroleum. Cables.—Henley's (e.h.v.); Hackbridge Cable Co. (h.v. and l.v.); Pirelli-General Cable Works (twin).

HACKNEY.—Electricity Committee. Recommended. Cables and flexible cords for twelve months (£4,211).—William Giepel. Electrical installation fittings and materials for twelve months (£210).—B.I. Cables.

STOKE NEWINGTON.—Electricity Committee. Recommended for twelve months. E.h.v., pilot and l.v. cables.—Henley's. Electric cookers.—Simplex Electric Co. Cooker control units.—J. H. Tucker & Co. Electric kettles.—Bulpitt & Sons. House service meters.—Aron Electricity Meter; Venner Time Switches; Chamberlain & Hookham. Conversion of d.c. meters of own make.—Measurement, Ltd. Electric wash-boilers.—Universal Boilers & Engineering Co. Electric water-heaters.—Johnson & Phillips; Santon. Installation work.—W.B. & H.C. Cables.

ST. PANCRAS.—Contracts and Stores Committee. Recommended. L.v. switchgear (£3,854).—English Electric Co. H.v. equipment for Fitzroy Road sub-station (£522).—A. Reyrolle & Co. Six 500-kVA transformers (£237 each).—G.E.C.

L.C.C.—Wiring and fittings in houses and flats at Bellingham:—

	£		£
Newman and Watson. Accepted	**6,565**	South Met. Electric Light and Power Co.	7,649
Ryland's Electrical Co.	6,691	G. E. Taylor and Co.	7,779
Holliday and Son (Electrical) ...	6,942	City Electrical Co.	7,798
Archibald Meckhonik	7,254	Jacob, White and Co.	7,964
Pemberton and Sturgess (G.B.)	7,358	Electrical Installations	7,999
Ellis and Ward	7,363	Springvale Electrical Co. ...	8,778

Wiring and fittings in one block of flats and five cottages at Wandsworth Road dwellings, Lambeth:—

	£		£
Holliday and Son (Electrical). Accepted	**364**	E. and C. Champion	439
Archibald Meckhonik	417	Carr Brothers	457
Jacob, White and Co.	434	Warren Smith and Co.	577

Wiring and fittings in blocks of dwellings at King's Mead estate, Hackney:—

	£		£
Carr Brothers. Accepted ...	**4,639**	W. J. Furse and Co. (London) ...	5,210
Archibald Meckhonik	4,649	Middlesex Electrical Co.... ...	5,294
Coleby and Co.	4,696	Alexander Hawkins and Sons ...	5,326
Jacob, White and Co.	4,947	Keeble	5,465
F. H. Wheeler and Co.	4,999		

Wiring and fittings in blocks of dwellings at High Hill Ferry areas, Hackney:—

	£		£
Jacob, White and Co. Accepted	**1,682**	Pinching and Walton	1,990
Ilford Electrical Co.	1,807	T. Clarke and Co.	2,006
Archibald Meckhonik	1,838	Newman and Watson	2,052
Samuel Reed and Sons	1,935	Springvale Electrical Co. ...	2,331
Bell Brothers and Co. (London)...	1,966		

Wiring and fittings for heating and the provision of telephones at the northern outfall works:—

	£		£
Harland and Wolff. Accepted ...	**1,700**	G. E. Taylor and Co.	2,131
Electrical Installations	1,785	Buchanan and Curwen	2,135
Barlow Brothers and Co. ...	1,795	City Electrical Co.	2,140
Read and Partners	1,879	Berkeley Electrical Engineering Co.	2,225
Holliday and Son (Electrical) ...	1,956	Francis Polden and Co.	2,350
W. H. Gaze and Sons	2,052		

Provision and erection of an electric bed lift for St. Peter's Hospital, Whitechapel:—

	£		£
Glasgow Engineers. Accepted ...	**879**	Express Lift Co.	1,330
Pickerings	1,166	Evans Lifts	1,360
Marryat and Scott	1,215	J. and E. Hall	1,380
Etchells, Congdon and Muir ...	1,262	Hammond and Champness ...	1,427
Bennie Lifts	1,283	Waygood-Otis	1,739

Manchester.—Water Committee. Accepted. Mercury-arc rectifiers, transformer, &c.—Electric Construction Co. Switchboard and circuit switches.—Switchgear & Cowans.

Transport Committee. Accepted. Overhead line materials for trolley-bus routes.—B.I. Cables.

Middlesbrough.—Tees-side Railless Traction Board. Accepted. Overhead equipment at South Bank (£576).—Clough, Smith & Co.

Newcastle-on-Tyne.—City Council. Accepted. Electric lighting in 312 houses on the Blakelaw estate.—R. W. Leek & Co.

Paisley.—Electricity Committee. Accepted. Transformers (£4,410).—Electric Construction Co.

Smethwick.—Education Committee. Recommended. Electrical installations in schools: Brasshouse Lane Infants (£398) and Junior (£401), Crocketts Lane (£1,419) and Waterloo Road (£642).—Etna Lighting and Heating. Abbey Road (£743), Bearwood Road (£763), Cape Infants (£587) and Junior (£510), Corbett Street (£520), Oldbury Road (£296), Smethwick Hall Infants (£270) and Boys' and Girls' (£642) and Waterloo Road Infants (£274).—S. W. & S. Electric Power Co. Victoria Special school (£145) and offices (£145).—J. E. Hemming.

Sunderland.—Town Council. Accepted. Electrical installation at the Prospect Row Junior Instruction Centre (£223).—D. Taylor.

Notes

Standard Synthetic Resin

The first of a new series of British standards for synthetic moulding materials, and mouldings made therefrom, which has just been issued, is intended to serve an entirely different purpose from that of B.S.S. 488—1933. That publication merely stated the minimum properties which any moulded article must possess when used for the specific purpose of electrical accessories. In contrast, the new B.S.S. 771—1938 specifies the actual properties of one particular type of moulding powder and moulding (phenol-formaldehyde), several commercial examples of which have been selected for classification into five groups, namely, Type G (general), Type GX (improved general), Type MS (medium shock-resistant), Type HS (high shock-resistant) and Type HR (heat-resistant). Mouldings, and the moulding materials from which they are made, are classified under the same designations. A valuable feature of the specification is the details of the standard conditions for preparing the test specimens which are given in appendices. A table shows the properties of each of the five types, and a purchaser can thus quote B.S.S. 771 and the type letter mark as the standard required, or build up a specification for a type not classified by selecting tests and fixing a performance. B.S.S. 771 does not give an exhaustive list of all the properties of phenolic materials which could be tabulated. A careful selection has been made so as to reduce the time and expense of testing any particular material. Standard methods of test include means whereby the quality of the work of the moulder may be specified. Copies of the new specification may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d., post free.

Sulphur Extraction Plant at Fulham

Each of the eight sets of the sulphur extraction plant installed at the Fulham power station has two valves of a special type for controlling the supply of liquor to the recirculating system. Due to the tendency of the solids in the liquor to settle out, special arrangements are required to prevent this settlement from lodging in the valve casings and from interfering with the working parts of the valves. The arrangement at present in use consists of injecting, intermittently, a supply of fresh water to the top of the valve casing, and, at the same time, opening drain valves at the bottom of the casing, so that the settled solids are washed out into drain trenches in the boiler house basement. The engineers have reported that this arrangement quickly showed itself as not being satisfactory. The flushing had to be done at frequent intervals, involving personal attention; also the sludge proved to be of such a consistency that it would not readily flow in the trenches, and hand labour had to be used for its removal. The pipework on the various sets was therefore not completed, and experiments were made by the engineers, as a result of which they have evolved a system which they state is entirely successful. Under this system the fresh water flushing is discontinued and a by-pass connection from the recirculating pumps is used to keep the liquor in constant motion in all parts of the valves, thus preventing any settlement of the solids. This system is self-contained, and the solids which would otherwise have settled out in the valves are constantly flushed back into the main liquor system. The discharge of solids into the boiler house basement is avoided, and the necessity for hand cleaning of the drain trenches is removed. The engineers recommend that this system shall be applied to each of the eight gas washer units.

Transmitting D.C. at High Voltage

At an informal meeting of the Institution of Electrical Engineers in London on March 14th Mr. J. E. Calverley opened the discussion by reviewing comprehensively various efforts that had been made to develop means of transmitting d.c. at high voltage. With the aid of lantern slides, he illustrated different groups of machines and their performance graphs, and more than one of the speakers who followed expressed the view that the ease of transmitting and transforming a.c. had caused its disabilities to be overlooked.

The Association of Ex-Siemens Men

The annual smoking concert of the Association of Ex-Siemens Men will be held at Gatti's Restaurant, Strand, next Friday, April 1st.

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

STEINER towel dryer and disinfector.
RADIO vacuum cleaner.
PRIDEWELL or PRIWELL washing machine.
GRAFTON cigarette lighter.

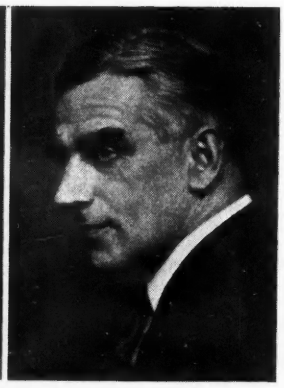
Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. F. Lonsdale and **Mr. E. A. Pitcher** have been appointed joint managers of Fraser & Chalmers Engineering Works, Erith. Mr. Lonsdale joined Fraser & Chalmers, Ltd., in 1909,

Mr. E. A. Pitcher



Mr. F. Lonsdale

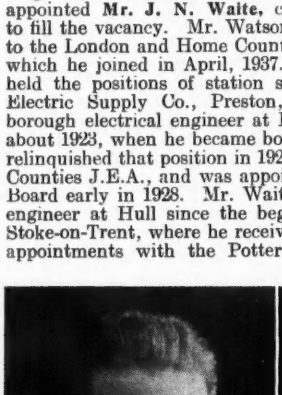
and after spending some time in the turbine section was appointed chief draughtsman and subsequently made manager of the turbine contracts department and drawing office. When the company was absorbed by the G.E.C. in 1918 he became sales manager. Mr. Pitcher joined Fraser & Chalmers, Ltd., in 1893, and after some years in the London office became assistant manager at Erith in 1914, when the executive offices were transferred to the works. At the change-over in 1918 he was appointed commercial manager. Mr. Pitcher has a specially wide knowledge of the mining industry.

Mr. F. H. Wynne, C.B.E., B.Sc., Deputy Chief Inspector of Mines, has been appointed Chief Inspector Mines in succession to **Sir Henry Walker,** C.B.E., LL.D. Sir Henry, who entered the Mines Inspectorate in 1902 and has been Chief Inspector for nearly fourteen years, retired on March 17th on reaching the age limit.

Mr. S. C. Howton, charge engineer with the Croydon Corporation Electricity Department, has been appointed assistant operating engineer with the Fulham Borough Council.

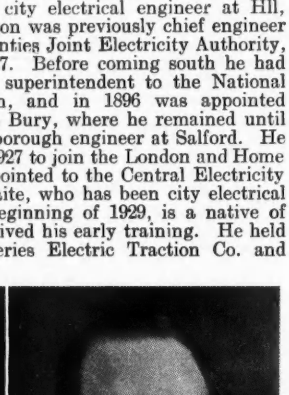
Mr. D. C. Lewis has been appointed electrical engineer and **Mr. D. Parry Jones** assistant engineer to the Caersws Electric Supply Co., Ltd. Mr. Lewis was formerly electrician to the Dinam Estates Co.

Mr. S. J. Watson, who for the past ten years has been the Central Electricity Board's district manager for South-East England, has intimated his desire to retire, and the Board has appointed **Mr. J. N. Waite,** city electrical engineer at Hll, to fill the vacancy. Mr. Watson was previously chief engineer to the London and Home Counties Joint Electricity Authority, which he joined in April, 1937. Before coming south he had held the positions of station superintendent to the National Electric Supply Co., Preston, and in 1896 was appointed borough electrical engineer at Bury, where he remained until about 1923, when he became borough engineer at Salford. He relinquished that position in 1927 to join the London and Home Counties J.E.A., and was appointed to the Central Electricity Board early in 1928. Mr. Waite, who has been city electrical engineer at Hull since the beginning of 1929, is a native of Stoke-on-Trent, where he received his early training. He held appointments with the Potteries Electric Traction Co. and later with the Newcastle-upon-Tyne Electric Supply Co. In 1921 he returned to Stoke-on-Trent to become chief assistant engineer to the Electricity Department, and served in that capacity for six years. He was deputy city electrical engineer at Bradford for a year prior to taking up his appointment at Hull.



[*Elliott & Fry*

Mr. J. N. Waite



[*Lafayette*

Mr. S. J. Watson

Mr. H. W. Gambrell has been appointed publicity manager to the Franco-British Electrical Co., Ltd., in succession to **Mr. M. Henry,** who has returned to the daily Press. For the past nine years Mr. Gambrell has been engaged in the publicity department of the Edison Swan Electric Co., Ltd., and previous to this he served in the merchandising section of the British Thomson-Houston Co.'s works at Rugby. His position with the Edison Swan Co. has been filled by **Mr. E. J. Peace,** formerly with Erwin Wasey & Co., Ltd., and G.B. Equipments, Ltd.

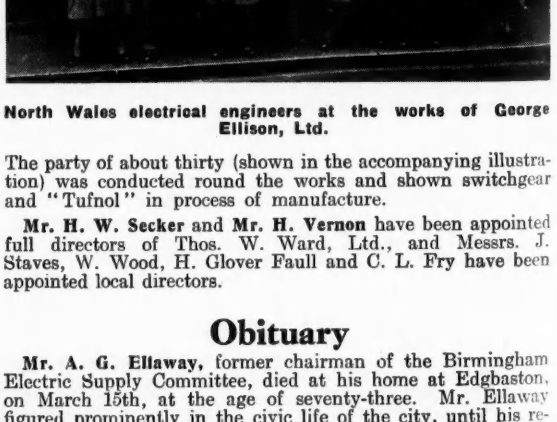
Mr. H. W. Gambrell

Dr. F. S. Sinnatt, Director of Fuel Research, Department of Scientific and Industrial Research, and **Mr. T. L. Eckersley,** research physicist to Marconi's Wireless Telegraph Co., Ltd., have been elected Fellows of the Royal Society.

Mr. A. Imbery, A.M.I.E.E., has been appointed sole representative of H. G. Moseley Co. for the sale of "Eddo" electric domestic appliances.

Mr. A. P. Quarrell, who has been in the service of Petters, Ltd., for many years, has been appointed London manager of the company at its new London office, Terminal House, Grosvenor Gardens, S.W.1.

The works of George Ellison, Ltd., and its associate company, Ellison Insulations, Ltd., were recently visited by members of the North Wales Power Co. and the North Wales Sub-Branch of the Association of Mining Electrical Engineers.



North Wales electrical engineers at the works of George Ellison, Ltd.

The party of about thirty (shown in the accompanying illustration) was conducted round the works and shown switchgear and "Tufnol" in process of manufacture.

Mr. H. W. Secker and **Mr. H. Vernon** have been appointed full directors of Thos. W. Ward, Ltd., and Messrs. J. Staves, W. Wood, H. Glover Faull and C. L. Fry have been appointed local directors.

Obituary

Mr. A. G. Ellaway, former chairman of the Birmingham Electric Supply Committee, died at his home at Edgbaston, on March 15th, at the age of seventy-three. Mr. Ellaway figured prominently in the civic life of the city, until his retirement from public life in 1936 for reasons of health. From 1904 until 1914 he was chairman of the Electric Supply Committee, and he was one of the first members of the original Tramways and Omnibus Committee, remaining a member until his retirement, and being chairman between 1924 and 1929. In 1931 he was president of the Municipal Tramways and Transport Association.

Mr. T. I. Rhodes.—Mr. Thomas Imrie Rhodes, chief electrical engineer for Alpha Cement, Ltd., Cliffe, died at Meopham on March 13th at the age of forty-five. For many years he was connected with Johnson & Phillips, Ltd. He superintended the laying of 280 miles of cable in connection with the electrification of the Southern Railway, and was concerned with the erection of new works for Alpha Cement, Ltd., at Purfleet and Cliffe.

Herr A. Riedl.—The death is announced from Wesel of Oberingenieur Anton Riedl, of the Rheinisch-Westfaelisches Elektrizitatswerk A.-G., which occurred at Bonn on March 12th. Herr Riedl was best known in this country for his development, in conjunction with Direktor O. Heinisch, of the same company, of the earth-leakage circuit-breaker, and its application to overhead line networks and installations in Germany. He was mainly responsible for the electrification of the Lower Rhine districts during the past twenty-six years, and the erection and equipment of the 220-kV stations at Wesel, and sub-stations at Kleve, Hamborn and Bocholt.

Mr. F. Wright.—The death occurred on March 14th at a London nursing home of Mr. Frank Wright, of the Bombay Electric Supply and Tramway Co.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Synthetic Rubber Products, Ltd.—Private company. Registered March 14th. Capital, £5,000. Objects: To carry on business as manufacturers of and dealers in rubber, balata, guttapercha, vulcanite, ebonite and similar natural and synthetic substances and compositions, &c. The directors are: A. M. Coulson, 6, High Drive, New Malden Surrey; and J. F. W. Tyler, 15, St. Stephen's Avenue, Ashtead, Surrey. Registered office: Ibex House, Minories, E.C.

W. Allen & Sons, Ltd.—Private company. Registered March 10th. Capital, £5,000. Objects: To carry on the business of manufacturers, repairers and hirers of and dealers in electrical and mechanical apparatus and accessories, and in particular of radio sets and valves, &c. The directors are: W. Allen, F. A. Allen and D. W. Allen, all of 260, Coleshill Road, Castle Bromwich. Registered office: 842, Alum Rock Road, Ward End, Birmingham.

Wright & Beyer, Ltd.—Private company. Registered March 16th. Capital, £1,000. Objects: To acquire the business of a mechanical and electrical engineer carried on by Lilian M. Wright as Wright & Beyer at Birkenhead. The directors are: Mrs. L. M. Wright and P. Wright, both of "Murragh," Ness Holt, Wirral, Ches. Registered office: 68, Old Bidston Road, Birkenhead, Ches.

E. J. Still & Co. (Electrical Engineers), Ltd.—Private company. Registered in Edinburgh March 15th. Capital, £2,000. Objects: To carry on the business of mechanical and electrical engineers, dealers in electrical machinery and accessories of all kinds, &c. The directors are: W. C. Cullen and Mrs. D. L. Cullen, both of 33, Blairhill Street, Coatbridge. Registered office: 53, Church Street, Coatbridge.

Times Radio Co., Ltd.—Private company. Registered March 17th. Capital, £1,000. Objects: To carry on the business of dealers in radio goods and accessories of all kinds, &c. The subscribers are: G. J. Evans, 79, Maindy Road, Cardiff, and D. B. Pryor, 95, Annabella Street, Cardiff,. Secretary: M. Roberts. Registered office: 114, Cowbridge Road, Cardiff.

Oxy-Arc Welding Co., Ltd.—Private company. Registered March 16th. Capital, £1,000. Objects: To acquire the business of an electrical and gas welder and general engineer carried on by S. A. Swayne at Cambridge Works, Hanwell, Mdx. The directors are: S. A. Swayne (permanent managing director), 26, Hanson Gardens, Southall, Mdx, and two others. Registered office: Cambridge Works, Cambridge Road, Hanwell, W.7.

British Electric Ray, Ltd.—Private company. Registered March 17th. Capital, £100. Objects: To acquire patents, rights and concessions; and to carry on the business of electricians, electrical engineers, &c. The subscribers are: V. A. Tanner and W. F. Janaway, 11, Old Jewry, E.C.2. Registered office: 11, Ironmonger Lane, E.C.2.

Mead Electric Co., Ltd.—Private company. Registered March 16th. Capital, £500. Objects: To carry on the business of electrical engineers and contractors, &c. The directors are: A. G. Mead, 8, Balmoral Gardens, Ealing, W.13; and W. T. Mead, 3, Laurel Gardens, Hanwell, W.7.

John Richards & Co. (London), Ltd.—Private company. Registered March 18th. Capital, £200. Objects: To carry on the business of electrical, mechanical, motor, telephonic, telegraphic and general engineers and contractors, &c. The directors are: H. E. Clarke (chairman), The Manor House, Whitnash, Leamington Spa, and four others. Registered office: 9, High Street, Burton-on-Trent.

Returns of Electrical Companies

L. Weekes (Luton), Ltd.—Satisfaction in full on October 16th, 1936, of a series of three debentures authorised by resolution dated January 29th, 1926, and registered February 4th, 1926, securing £1,000 each. Debenture charged on freehold land in Wingate Road, Luton, leasehold premises in Longley Street, Luton, and the company's undertaking and property, present and future, including uncalled capital, dated February 28th, 1933, to secure £20,000. Holders: Westminster Bank, Ltd.

Silvagrey Electric, Ltd.—Debenture charged on the company's property, present and future, including uncalled capital (if any) dated March 9th, 1938, to secure £1,000. Holder: H. J. Walmsley, 14, Lucknow Drive, Nottingham.

Corona Lampworks (Southern), Ltd.—Particulars filed of £56,000 debentures, authorised March 3rd, 1938, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Machynlleth Electric Supply Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated February 25th, 1938, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

H. A. Stonham & Co., Ltd.—H. W. T. Sinden, of 12, Lonsdale Gardens, Tunbridge Wells, ceased to act as receiver and manager on February 24th, 1938.

City Notes

The County of London Electric Supply Co., Ltd., held its annual meeting on March 22nd, when Sir Bernard Greenwell, Bt. (chairman), who presided, said that during the past year they had sold approximately 165 million more kWh to their consumers, which was an increase of 16 per cent. over the previous year's sales. They exported to the Central Electricity Board 116 million kWh less than in the previous year, but on balance there had been an increased output of 62 million kWh. Their capital expenditure for the year was over £1,500,000, which included large payments for the extensions at the Barking station and also final payments on the new transmission system between Barking and Streatham. They brought into operation the third 75,000 kW set at Barking, and had now been asked to start on the fourth set of the same size. Construction work on this set and for four complete boiler units involved the enlargement of the turbine house, boiler house, and switch house. The capital sub-station at Valley Road, Streatham, which was the largest of its kind in the country, was brought into service in August last, and about 128 million kWh had passed through this sub-station by the end of January. During the year important constructional works had been carried out at other of their large sub-stations. They had established 170 new sub-stations, laid down 100 miles of h.v. lines and about 500 miles of l.v. mains. Referring to the comparisons between municipal and private enterprise made by advocates of municipal control, Sir Bernard mentioned that private enterprise to-day was responsible for the supply of electricity over 73,600 square miles, with a revenue of £408 per square mile, whereas municipal authorities were only responsible for 14,500 sq. miles, from which they derived a revenue of about £3,500 per square mile. Large urban and rural areas were left to private enterprise, and it had only been by economic planning and expenditure that such areas had eventually been made to pay. Regarding the proposed legislation, it seemed unwise to cause a wholesale upheaval, as from their knowledge the smaller undertakings were well managed, and it would be a mistake to force them to give up their identity. The two-part tariff had now been adopted by 81 per cent. of their consumers, and the average rate paid by their domestic two-part tariff consumers for the year was 1.57d. per kWh throughout the whole of their area. The flat rate for their city areas was 4½d. per kWh, and at the beginning of this year the flat rate in the suburban areas was reduced from 5½d. to 5d. per kWh, while in the very rural areas they had a uniform flat rate of 6d. per kWh. There was a further expansion in street lighting business. They had obtained extensions to existing contracts and had obtained a number of new contracts. The number of lamps installed would be about 16,000 covering over 500 miles of main roads and streets, and the sales of electricity for street lighting during 1937 showed an increase of 68 per cent. over those for the previous year. These particulars did not include the expansion of this business in the subsidiary companies' areas, where they had lighted over 400 miles of roads and had several further contracts in negotiation. Two new showrooms had been opened, making twenty-four for their areas and sixty-nine for their company and their subsidiary and associated companies. The agreement made during the year with the City Co. had already been put into operation. An interconnection of mains had been made, and supply had been given, and they were on the point of putting into force a conjoint management of their Holborn and Finsbury areas in the area of the City Co., with the aim of attaining uniformity of rates and policy over a large area. The detail management of this area would fall to be operated by the City Co. working with them through their joint executive committee. Their subsidiary and associated companies were keeping in step with the parent company in development, reduced prices, and increased receipts. The progress of the County Co. was equally good for the first two months of this year. KWh sold had increased by over 17 per cent., and the revenue for the first two months by over 11 per cent. in spite of reduced charges.

The British Thomson-Houston Co., Ltd., held its annual meeting on March 22nd, when Mr. W. C. Lusk (chairman), who presided, said that the level of general business activity was higher during the year than for the previous year, and they received their share of the increased business resulting therefrom, both at home and from overseas. Among the interesting contracts completed during the year in which they participated were the electrification of the Wirral lines of the L.M.S. Railway, the Tyneside line of the L.N.E. Railway, the Randfontein-Springs line at Johannesburg, and the extension of the Natal main line of the South African Railways. There

was again an increased demand for their "Mazda" lamps, for their "Mercra" electric-discharge lamps for street lighting, and also for all the various electrical appliances which were manufactured by them for their subsidiary selling company, the Hotpoint Electric Appliance Co., Ltd. The orders received and the shipments made from their factories were greater than in any previous year, and the unexecuted orders on hand at the end of the year, and the number of their employés, also constituted records. At the meeting a year ago he mentioned that the level of business activity existing at that time could hardly be expected to continue indefinitely, and they had not been surprised that there had been a falling-off during the past few months. They regarded 1937 as a peak year in the industry, and they did not expect that the volume of business available in 1938 would be as great. But they did not expect any serious recession and were not disturbed at the prospect of some falling-off in incoming orders, particularly as they started the year with a large unfulfilled order book. The work of their research department was further extended during the year to meet the necessities of their increased business, and for the continued study of new fields allied to those in which they were working.

The Bournemouth and Poole Electricity Supply Co., Ltd., reports a net revenue for the year ended December 31st of £183,323, as compared with £181,673 in the preceding year, to which is added £13,553 brought in, making £196,877. After providing for debenture interest and placing £50,000 to reserve for depreciation, renewals, &c., and £5,000 to general reserve, it is proposed to pay a final ordinary dividend of 9 per cent., making 15 per cent. for the year (same) and to carry forward £16,537. The sales of electricity totalled 58,773,984 kWh, an increase of 11,677,000 kWh, and the number of consumers 56,429, an increase of 5,702. During the year reductions were made in the flat rates for lighting, heating and cooking in the Swanage area and in flat rate for lighting in the Wimborne areas, and a special rate for water heating was introduced throughout the company's rural areas. Additional contracts for public lighting were obtained from the Bournemouth Corporation and from the Bere Regis Parish Council, and a new contract was obtained from the Poole Corporation. The supply was extended to a number of new districts. Meeting: March 29th.

Veritys, Ltd.—Presiding at the annual meeting on March 21st Mr. B. C. Evans (chairman and joint managing director) said that the extensions to the factory referred to last year had been delayed, chiefly due to difficulty in obtaining the steel required, and they were not yet available. To meet the cost of these extensions a further £35,000 of capital was raised in February of this year. They expected that they would be in occupation of the new building by the end of May, and the delay had not been a very great handicap. Judging from the orders now in hand it was anticipated that the progress shown during the year under review would be maintained. They felt that they were now able to extend their design and research facilities, which should add to their prestige in the industry. Their marine and shipbuilding departments showed that they were getting their share of the orders going, and they had revived their export associations all over the world.

The Newcastle and District Electric Lighting Co., Ltd.—Presiding at the annual meeting held on March 18th Col. Sir Frank R. Simpson, Bt., said that the sales of electricity during the year were 1¼ million kWh more than in 1936, and in view of the reduction made in the charges for electricity amounting to £7,645 and the increased cost of coal, the results were satisfactory. During the year 1,775 new consumers had been connected and considerable extensions made to existing installations. The demand for the installation of cookers, water heaters and other heating appliances showed a steady increase, and this class of business was now taking a larger part in their expansion.

The South Metropolitan Electric Light & Power Co., Ltd., in its accounts for 1937, shows a net working profit of £240,052, as compared with £200,558 in the previous year. After writing off debenture issue expenses and placing £90,118 to depreciation reserve, £2,500 to taxation reserve, and £17,500 to general reserve, it is proposed to maintain the ordinary dividend for the year at 9 per cent. by the final payment of 6 per cent., and to carry forward £43,516. The ordinary dividend for 1936 was paid on smaller capital. The sales of electricity amounted to 167,195,000 kWh (against 139,650,000 kWh) and the number of consumers increased by 10,662 to 58,841.

The Hoffmann Manufacturing Co., Ltd., reports net profits for 1937 of £205,929, as against £168,466 in the preceding year. The final ordinary dividend is 10 per cent., making 20 per cent. for the year. The final dividend is paid on capital as increased by the 100 per cent. share bonus distributed in December. General reserve receives £50,675 and debenture redemption reserve £50,000. The balance carried forward is £60,869.

The Lancashire Dynamo & Crypto, Ltd., reports a net profit for 1937 of £133,270, as compared with £82,147 in 1936, to which is added £43,635 brought in. The ordinary dividend for the year is 25 per cent., £6,750 is placed to staff funds, £5,000 to reserve for N.D.C., and £1,668 to general reserve, and £66,561 is carried forward. The dividend for 1936 was 20 per cent. and was paid on smaller capital.

The British Sangamo Co., Ltd., reports net profits for 1937 of £59,340, as compared with £73,072 for 1936. General reserve receives £25,000 and the ordinary dividend for the year is maintained at 15 per cent., leaving £60,831 to be carried forward (against £49,091 brought in).

The Woking Electric Supply Co., Ltd., reports a profit for 1937 of £52,303, as compared with £54,311 in 1936. The final ordinary dividend is 4½ per cent., making 7½ per cent. for the year, tax free, and £2,221 is carried forward (against £2,274 brought in). The number of consumers connected increased from 15,764 to 17,444.

McMichael Radio, Ltd., reports a net profit for 1937 of £17,703, as against £29,732 for 1936, to which is added £1,644 brought in. A dividend of 8 per cent. (against 10 per cent.) is paid on the cumulative participating preferred ordinary shares, being arrears to March 31st, 1936, and £5,000 is written off preliminary expenses and underwriting commission. The balance carried forward is £294.

Allen West & Co., Ltd., report a net profit for the year to January 31st of £63,736, as compared with £37,352 for the previous year. It is proposed to pay a dividend of 7½ per cent. (the first since that for 1929-30), to place £15,000 to general reserve, and to carry forward £36,200 (against £37,352 brought in).

The Anglo-Argentine Tramways Co.—At meetings of holders of the 4 per cent., 4½ per cent., and 5 per cent. debenture stocks on Monday last, approval was given to the scheme of arrangement, arising from the proposed co-ordination of urban transport in Buenos Aires.

The British Power & Light Corporation, Ltd., held its annual meeeting on March 18th when Capt. C. E. Benson (chairman), who presided, said that the North Wales Power Co. made an issue during the year of 2,000,000 shares of 10s. each, of which 1,983,409 shares were allotted to the Corporation at a cost of £1,140,460. Out of the proceeds of this issue the North Wales Power Co. repaid the debentures issued to, and the advances made by, the Corporation. In 1936 the Power Company's hydro-electric stations generated 70 per cent. of the total requirements in North Wales, the balance representing the net purchases from the Central Electricity Board. During 1937 the generating station contributed only 52 per cent., the net purchases from the Central Board increasing to 48 per cent. of the total requirements. While the increased purchases from the Board were the result of new business and increased sales to consumers generally, the lack of rainfall in the latter half of the year resulted in a substantial reduction in the output of the hydro-electric stations when compared with 1936. During a year of good rainfall the Power Company's generating stations were capable of producing upwards of 100,000,000 kWh, but in the year under review the rainfall was equivalent to only 66,000,000 kWh. During the year over 9,000 new consumers were obtained by their subsidiary companies, bringing the total connected to more than 66,000 at the end of the year. Extensions to the transmission system and distribution mains carried out during the year by the subsidiary companies amounted to over 200 miles. Many of these lines opened up new ground, particularly in the New Forest and in the North Wales area along the Shropshire border, and in parts of Caernarvonshire and Anglesey, where the second scheme of development was nearing completion. It was proposed shortly to submit further schemes for development in Anglesey for the approval of the Electricity Commissioners. During the year the tariffs in North Wales were reduced, and these reductions and the reductions already made in the tariffs of the English companies, to which reference was made last year, had been fully justified by the increase in the number of consumers and the growth of sales.

Brown Bros., Ltd., held their annual meeting on March 18th, when Mr. J. A. Morrison (chairman and managing director), who presided, said that during 1937 trade had been good in almost every department, and they had again created new records both as regards total value and volume of turnover. They had endeavoured to restrict their radio business to the products of manufacturers who conformed to established and sound methods of distribution, and their sales had been confined to established and *bona fide* radio retailers. In consequence, they had not been involved in any serious losses. They had increased the scope of their electrical departments. Additional premises had been secured at the head office with a frontage to Great Eastern Street, and these had been equipped as electrical showrooms. Their lighting engineering service, which specialised in the floodlighting of factories, workshops, petrol stations and garages, had expanded. During the year they had had a satisfactory turnover in all their old-established export markets. A site had been acquired at Acton for a branch to serve the western and north-western districts of Greater London, and they were building premises there which would be completed at an early date.

Pinchin Johnson & Co., Ltd.—Presiding at the annual meeting held on March 21st Mr. E. Robson (chairman) said that in the home market and foreign markets, apart from China and France, where they were directly or indirectly interested, progress had been satisfactory, and a new record of sales and profits had been established by their Australian company. The home trade had shown a gratifying increase in sales, though the question of price debasement was one that was capable of improvement. In the last three months of 1937 there was a slowing-up in the rate of progress of their business, but during January, February and up to date in March their sales again showed an upward trend, and higher than that of the corresponding period of last year. Progress had been made in the research and technical divisions of their business and some products of outstanding properties were available.

The Richmond (Surrey) Electric Light & Power Co., Ltd., reports a revenue balance for 1937 of £33,661, as compared with £32,363 in the previous year, which with £1,643 brought in makes £35,304. A sum of £1,535 is contributed to sinking fund and £10,000 is transferred to reserve for depreciation, renewals, &c. It is proposed to pay a final dividend of 4 per cent., making 7 per cent. for the year, less tax (same), and to carry forward £2,069. The sales of electricity during the year totalled 12,862,762 kWh against 11,199,535 kWh in 1936. A reduction in the flat rate for lighting was made during the year. Meeting: March 29th.

The Watford Electric & Manufacturing Co., Ltd., reports a net profit for 1937 of £22,635, as compared with £7,609 for the period June 25th to December 31st, 1936, to which is added £790 brought in. After providing for tax and N.D.C., and reserve for buildings, it is proposed to pay a final ordinary dividend of 10 per cent., less tax, making 15 per cent. for the year (against 7½ per cent.), and £7,767 is carried forward. The report states that the value of orders received during the year was over 30 per cent. in excess of the preceding year, and the value of those obtained since January 1st also shows an increase as compared with the corresponding period of last year. Meeting: March 30th.

The British Aluminium Co., Ltd., reports net profits for 1937 of £773,432, as compared with £597,181 in the preceding year. After providing for debenture interest, depreciation, taxes, &c., it is proposed to pay a final ordinary dividend of 8½ per cent., making 12½ per cent. for the year (against 10 per cent.). The amount payable on the new ordinary capital, calculated according to the terms of the issue, is £1 15s. 10d. per cent. The balance carried forward is £101,423. The report states that the demand for the products of the company remained at a satisfactory level throughout the year and both output of aluminium and the tonnage sold constituted a record. A part of the new plant at the Lochaber works of the North British Aluminium Co., Ltd., has recently been put into operation, and the remainder will be completed in the near future. Meeting: March 29th.

London Associated Electricity Undertakings, Ltd., held its annual meeting on March 22nd. The Earl of Lytton (chairman), who presided, said that the progress made in carrying out the company's policy in 1936 was accelerated in 1937. The consent of the Electricity Commissioners having been received to an amalgamation of the constituent companies, the necessary Orders of the Court were obtained. The six constituent companies now, therefore, operated as one company under the name of Central London Electricity, Ltd. The agreement under which their company managed the constituent companies had been terminated. The board of Central London Electricity was identical with that of London Associated. The management of Central London Electricity was now under the control of its own board, and the functions of London Associated were therefore entirely those of an owning company. The standard two-part tariff had been considerably reduced from the beginning of this year and was now among the lowest in the country. The "unit" charge both for commercial and domestic purposes was ½d. The total supply had increased to 419 million kWh, and the connected load to 592,000 kW; 4,300 new consumers were obtained during the year; 1,900 additional cookers were supplied on hire, an increase of 650 over the previous year, and much additional commercial cooking load was obtained. Early this year a new showroom was opened in Regent Street. The engineering work in connection with the standardisation of the system of supply was proceeding satisfactorily, and during the year 6,700 consumers' installations were changed over to the standard system. General reorganisation of the stations and mains to conform to a centralised engineering policy had proceeded along lines commercially justifiable and was being continued. During the year half a million pounds was spent on capital works and £100,000 on changing consumers' apparatus.

Switchgear & Cowans, Ltd.—Presiding at the annual meeting on March 22nd, Mr. H. Burroughes (chairman) said that during the year they had acquired two additional subsidiary companies, each of which made an important section of the equipment which they sold. They were housed in a new building adjacent to the main works. The acquisition of their three subsidiaries enabled them to produce their switchgear equipment at a more favourable cost than if they had to purchase from outside sources, and each was able to sell its surplus production to outside customers, thus broadening the basis of their business. The extensions to the works buildings and plant referred to last year were completed in October last. The manufacturing layout had been improved, but it entailed moving a considerable amount of machinery and equipment. In spite of this disturbance the profit was substantially increased. The welfare centre had been completed, and they had introduced a superannuation scheme for men, a savings scheme for women and payment for holidays throughout the works. They had no evidence in their business of a trade recession. Their carry-over of unexecuted orders at December 31st was 40 per cent. greater than at the end of the last financial year.

British Insulated Cables, Ltd., reports a profit for 1937 of £821,358 as compared with £765,695 for the previous year, to which is added £380,879 brought in, making £1,202,237. After providing for depreciation on fixed assets, directors' remuneration, and debenture interest, &c., it is proposed to place £100,000 to reserve, and to pay a final ordinary dividend of 10 per cent., making 15 per cent. for the year, and a cash bonus of 5 per cent., both less tax, leaving a balance of £446,992 to be carried forward. Meeting: April 1st.

The Mid-Cheshire Electricity Supply Co., Ltd., reports a net profit for 1937 of £22,542, as compared with £22,377 for 1936. The ordinary dividend for the year is maintained at 8 per cent., £1,400 is transferred to employés' bonus account, and £5,478 is carried forward. During the year the company purchased from the Salt Union, Ltd., its holding of the majority of the ordinary shares in the Mersey Power Co. In order to cover the transaction the authorised capital of the Company was increased in October last from £300,000 to £700,000, and an issue of new shares has since been made.

The Midland Electric Corporation for Power Distribution, Ltd., reports, in a preliminary statement, a net profit of £146,033 for 1937, as against £127,139 for 1936, plus £44,262 brought in. From this is deducted £23,284 for income tax, £19,500 for debenture interest, and £25,000 is placed to reserve. It is proposed to pay a final dividend of 6 per cent., making 9 per cent., less tax, for the year (same) and to carry forward £49,048. A further amount of £35,000 is transferred to reserve from profit on the sale of investments.

The Mersey Power Co., Ltd., reports a net profit for 1937 of £76,412, as compared with £71,236 in the preceding year, to which is added £4,510 brought in. The ordinary dividend for the year is 8 per cent. (against 7½ per cent.), and £8,204 is carried forward (against £4,510 brought in). The report states that consent has been obtained to extend the power station by the installation of one 30,000-kW turbo-generator. Meeting: March 25th.

W. Canning & Co., Ltd., report a net profit for 1937 of £87,156, as compared with £83,570 in the preceding year. To this is added £28,292 brought in, making £115,448. General reserve receives £10,000 and reserve for contingencies and new offices £5,000. The final ordinary dividend is 5 per cent., making 10 per cent. for the year, less tax, plus a bonus of 3s. per share, less tax (same). A sum of £3,000 is placed to employés' benevolent trust fund and £41,198 is carried forward.

The Telephone & General Trust, Ltd., reports a net profit for 1937 of £107,637, as compared with £108,996 for the previous year, to which is added £65,782 brought forward. The final ordinary dividend is 5 per cent., making 8 per cent. (same), and 8 per cent. on the "A" ordinary (same). Reserve receives £10,213 and £63,206 is carried forward.

Associated Electrical Industries, Ltd., in a preliminary statement, recommends a dividend of 10 per cent. on the ordinary stock for 1937 (unchanged), after appropriating £100,000 to special reserve and £100,000 to dividend equalisation account. The carry forward is increased from £176,118 to £220,015.

The Kent Electric Power Co. reports a profit for 1937 of £98,179, to which is added £84,250 brought in. After providing for debenture interest, &c., it is proposed to pay a dividend of 8 per cent., less tax, for the year. Electricity purchased amounted to 223,300,000 kWh, and sales were 212,600,000 kWh.

The Anglo-American Telegraph Co. has announced an interim dividend for the quarter to March 31st of ¾ per cent. on the ordinary shares (same) and 1½ per cent. (same) on the preferred ordinary shares.

The Automatic Telephone & Electric Co., Ltd., has declared a final dividend of 7 per cent. on the ordinary stock, making 10 per cent. for the year, less tax, and a dividend of 10 per cent., less tax, on the deferred stock.

The American Telephone & Telegraph Co. reports a total income for 1937 of $197,810,195, as compared with $199,269,492 in the previous year, and a net income of $179,834,815 (against $174,826,414). Dividends of $9 per share were again paid, and the surplus is $11,653,909 (against $6,745,235).

The Tewkesbury Electric Light Co., Ltd., shows a profit for 1937 of £676. The ordinary dividend is again 5 per cent. and £234 is carried forward.

The Kidderminster and District Electric Supply Co., Ltd., reports a profit for 1937 of £6,857 (against £6,297 in 1936). The ordinary dividend is maintained at 4 per cent. and £966 is carried forward (against £299 brought in).

The Isle of Thanet Electric Supply Co., Ltd., reports a profit for 1937 of £50,595, which with interest (£2,950), and £1,235 brought in makes £54,780. It is proposed to pay an ordinary dividend of 4 per cent., and to carry forward £3,117. Meeting: March 30th.

The Shanghai Electric Construction Co., Ltd., is paying a final dividend of 5 per cent., making 7 per cent. for the year. For each of the three preceding years 13 per cent. was paid.

Stocks and Shares

TUESDAY EVENING.

AFTER the flatness which fell upon the Stock Exchange markets last week, the complete change-over in conditions that started on the Monday in the present week was very welcome to markets which had suffered severely in the slump. However unjustified may have been the apprehension of hostile air raids, there can be no doubt as to the effect which this produced upon the public mind; an effect which found reflection in every market round the Stock Exchange.

As our own price lists showed last week, the investor was greatly disturbed by the prospect of a huge loan being required for defence purposes, an immediate advance in income tax, and the vague fears just mentioned of possible attack. The banks put pressure upon customers who were running loan accounts to have these strengthened, or paid off, one result of which was to bring about a certain amount of forced selling on unwilling markets, than which there are few more upsetting factors that enter into Stock Exchange business. Calmer news from the Continent and the cessation of nervous or compulsory realisations caused so complete a revulsion that stock became almost as difficult to buy as, previously, it had been hard to sell.

Gilt-edged Securities

Political considerations apart, first feelings on the prospect of inflated expenditure on armaments were that the gilt-edged market might have to shoulder a particularly heavy burden. Whether the Government decided to raise the bulk of the extra money by more taxation or by bigger borrowing, it was thought that Government and other fixed-interest stocks were liable to be to some extent sufferers, either way. The one method would, of course, cut into net income; the other might tend to depress prices. These were among the considerations which weighed heavily last week on gilt-edged prices. War Loan was at one time below par, but the turn-round in sentiment brought about a recovery to 101¾. Among public board issues, Central Electricity Board stocks are mostly down by about 2 points. London Transport issues came off more lightly. West Midlands 5 per cents. lost 2 points, to 111. London and Home Counties 4½ per cents. are unchanged at 112.

Underlying Strength

The fact that gilt-edged prices have rallied appreciably since the first knock-down blow shows that the stocks have substantial supporters. For one thing, it is pointed out that the volume of money awaiting employment has not diminished; while, simultaneously, the attraction of safety-first employment for these funds has become greater. Underlying the normal forces which afford strength to gilt-edged prices, is the monetary policy of the Treasury; obviously the authorities will be concerned to keep money cheap while the vast borrow-

ing plans are on hand. So far as the ordinary investor is concerned, there is some disquietude over the prospect of a rise in prices generally and, therefore, in the cost of living. This, some people think, might start a movement away from fixed-interest stocks into higher yielding holdings, leaving support for the gilt-edged market largely in the hands of the big institutions. So far, however, the market's behaviour has done little to suggest that this argument will hold good.

Electricity Supply

Owing to the stable rates of dividend paid on most electricity supply ordinary shares, this market is governed to a large extent by the same considerations as determine the prices of fixed-interest stocks. Quotations have therefore been somewhat unsettled by uneasiness over the possibility of a rise in the cost of living. Hence the past fortnight's price-falls can be explained by the change of ideas as to what constitutes an adequate yield from shares of this kind: there is no serious doubt as to the ability of the companies to maintain their dividends, even though there may be difficulty in passing on to consumers a part, at least, of possibly higher expenses. Many share-prices have again been marked down between 6d. and 1s. 6d., but there has been appreciable recovery from the lowest points. Among the worst sufferers were North Easterns, now 28s. 6d., after being down to 27s. 6d., Electrical Distribution of Yorkshire at 39s. and Yorkshire Electric at 37s. 6d. London Associated stayed at 30s., but "Mets." and "North Mets." gave way to 45s. 6d. and 46s. 3d. respectively. The average of yields on electricity supply shares has risen to the region of 4½ per cent., which seems to make allowance for most of the unfavourable possibilities.

The Outlook for Industrial Shares

After the first rush to turn everything marketable into cash, prices in the industrial markets are showing signs of response to the activities of bargain-hunters and to a more discriminating attitude on the part of investors. It is coming to be realised that the ill-wind of extra rearmament expenditure is not going to be as impartial as was at first feared. While some branches of industry are under the threat of special taxation, or of interruption through taking second place to sections employed on more urgent business, there remains the probability that a fresh stimulus will be given to a number of industries where of late a flagging of activity was beginning to arouse concern. Given the likely rise in commodity prices, moreover, expectation will look for an improvement in export business as a sequel to there being more money to spend in the countries which produce raw materials. The prospect of higher company profits resulting, directly and indirectly, from expenditure on armaments, is weighed against the chances of higher taxation. Many observers are prepared to see a balance favourable to the holder of industrial ordinary shares. Yields on the latter are up to a level which has become doubly attractive to those who believe that gilt-edged investments may lose some of their popularity.

South African Cables

The Cable Makers' Association, which is composed of about twenty of the leading cable makers, *e.g.*, Henleys, British Insulated, Callenders, Crompton Parkinson, Enfield Cable and General Electric, has paid 39s. per share for 156,000 ordinary shares of £1 each of African Cables, Ltd. This is 60 per cent. of the capital of African Cables, a company which operates in South Africa, its shares held by some of the principal Kaffir houses. African Cables is not much more than two years old, and its full plant will not be in operation until June or July next. Up to the present it has stood outside what may be described as the ring of cable manufacturers, and this purchase of 60 per cent. of its capital has the effect, of course, of bringing it under the control of the British Cable Makers' Association.

From the point of view of Stock Exchange quotations, the deal exercises no effect. Presumably the 156,000 shares will be divided amongst the various constituent members of the British Cable Makers' Association, and will be held by them as part of their investments.

Equipment and Manufacturing

Electrical equipment shares were not slow to participate in the brighter feeling throughout the markets, but some of the prices still suffered fairly large losses on the week. There was general disappointment over the absence of an increase in the Associated Electrical dividend, and the shares dropped 1s. 6d., to 36s. 6d. ex-dividend. The coming report will, it is hoped, restore good feeling by showing that the rate of dividend was decided as much by politics as by profits. Enfield Cables have again been under fire; at 4½, the price is 10s. down. Johnson and Phillips have shed 2s., to 36s. 3d., but other cable shares are steady. Lancashire Dynamos have fallen away to 57s. 6d., making the yield nearly 8¾ per cent. on the newly declared dividend of 25 per cent. Allen Wests eased off to 5s. 9d. after the declaration of a 7½ per cent. dividend—the first since 1930. Electric Constructions fell 3s. 9d., to 32s. 6d. Smaller losses are shown by General Electrics, at 69s., Crompton Parkinsons, at 22s. 6d., Siemens, at 26s. 3d., and by several others. There is a slight recovery in Walsall Conduits, at 23s. 3d. ex-dividend. British Aluminiums have moved up 3/16, to 45s. 9d. ex-dividend since declaration of the 12½ per cent. dividend.

Share List of Electrical Companies

	Dividend. Nom. Previous.	Dividend. Last.	Price Mar. 22.	Rise or Fall.	Yield. p.c. £ s. d.
HOME ELECTRICITY COMPANIES.					
Bournemouth and Poole	1	15	63/9	−¼	4 14 4
City of London	1	7½	33/6	−6d.	4 9 7
Clyde Valley	1	7	38/−	−6d.	4 4 3
County of London...	1	10½	47/−	−1/−	4 9 4
Edmundson's 7% Pref.	1	7	32/−	−6d.	4 6 2
Do. Ord.	1	8	36/−	−1/−	5 0 0
Elec. Dis. Yorkshire	1	9	39/−	−2/−	4 12 4
Elec. Fin. and Securities... ...	1	12½	48/9	−¼	5 2 6
Elec. Supply Corporation ...	1	12	51/3	−¼	4 13 8
Lancs Light and Power	1	7½	32/6	−6d.	4 12 4
Lond. Assoc. Electric	1	7	30/−	—	4 13 4
London Electric	1	7	35/6	—	3 19 0
London Power Deb. Red. ...	Stock	5	104½	−½	4 15 8
Metropolitan	1	12	45/6	−6d.	5 5 6
Midland Counties	1	8	35/6	−6d.	4 10 0
Mid. Elec. Power	1	9	38/9	−¼	4 13 0
North Eastern Electric Ordinary	1	7	28/6	−1/6	4 18 4
Do. 7% Pref.	1	7	32/6	—	4 6 2
Northampton	1	10	46/3	—	4 6 7
Notting Hill 6% Pref.	10	6	14	—	4 5 9
North Met. Elec. Ordinary ...	1	10	46/3	−¼	4 6 6
Do. do. 6% Pref. ...	1	6	30/−	—	4 0 0
Scottish Power	1	8	35/−	−1/−	4 11 5
South London	1	7	32/−	—	4 7 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	17/6	−6d.	8 11 6
Yorkshire Elec.	1	8	37/6	−1/6	4 5 4
PUBLIC BOARDS.					
Central Electricity, 1950–70 ...	Stock	5	110½	−2½	4 10 6
Do. 1955–75 ...	,,	5	114½	−1½	4 7 2
Do. 1951–73 ...	,,	4½	108½	−2½	4 3 0
Do. 1963–93 ...	,,	3½	98½	−1½	3 11 0
London Elec. Trans. Gtd. ...	,,	2½	92	−½	2 14 4
London & Home Counties, 1955–75	,,	4½	112	—	4 0 4
London Passenger Transport, A...	,,	4½	117½	−1	3 16 6
Do. do. B...	,,	5	120½	−1	4 3 0
Do. do. C...	,,	4½	79	−3	5 7 7
West Midlands Joint Elec. 1948–68	,,	5	111	−2	4 10 1
TELEGRAPH AND TELEPHONE.					
American Tel. & Tel.	$160	9	120½xd.	−1	6 19 0
Anglo-Am. Tel. Pref.	Stock	6	107½xd.	−1	5 11 7
Do. Def.	,,	1½	26½	−½	5 13 2
Cable & Wireless 5½% Pref. ...	,,	4½	98½	−1½	5 11 8
Do. Ord.	,,	—	59½	−1	—
Do. Income	,,	—	101½	—	3 18 10
Globe Tel. & Tel. Ord.	10	4½*	13½	−¾	4 3 0
Do. do. Pref.	10	6	13	−¾	4 12 4
Great Northern Tel.	10	20	39	−½	5 2 7
Marconi-Marine	1	10	7½	27/6	— 5 9 1
Oriental Telephone Ord.	1	12*	12*	2 11/16	— 4 9 3
HOME AND FOREIGN TRAMS, ETC.					
Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	3/9	−2/3 —
Do. do. 2nd Pref.	5	Nil	Nil	3/9	— —
Do. do. 5% Deb.	Stock	Nil	Nil	12	−1½ —
British Electric Traction Def. Ord.	,,	5	5	900	+100 —
Do. do. Pref. Ord.	,,	8	8	155	−5 5 3 3
Brazil Traction	$100	70 cts.	$1	9	−1 —
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	99½	−3 5 0 6
Mexican Light Common	$100	Nil	Nil	1½	— —
Do. 1st Bonds...	$500	5	5	30	−5 —
Victoria Falls Ord.	1	20	12	56/3	−½ 4 5 5
West Riding	1	6½	10	37/6	−¼ 5 6 8
MANUFACTURING COMPANIES.					
Aron Electricity Ord.	1	15	15	1½	— 8 0 0
Assoc. Elec. Ord.	1	10	10	36/6xd.	−1/6 5 9 3
Do. Pref.	1	8	8	38/−	— 4 4 6
Babcock & Wilcox	1	8	10	40/−	−2/− 5 0 0
British Aluminium Ord.	1	10	12½	45/9xd.	+¾ 5 9 2
British Insulated Ord.	Stock	20	20	4½	— 4 17 1
Brush Ord.	Stock	Nil	Nil	17½	−2 —
Callender's...	1	15	15	4½	— 3 12 9
Do. 6½% Pref.	1	6½	6½	31/3	— 4 2 4
Crompton Parkinson Ord. ...	5/−	12½	12½	22/6	−¼ —
Do. 8% Pref.	1	8	8	37/6	— 4 5 4
Electric Construction	1	7	10	32/6	−¾ 6 3 1
Enfield Cable Ord.	1	25	25	4½	−½ 5 19 2
English Electric	1	Nil	10	27/6	−1/6 7 5 6
Do. do. Pref.	1	6½	6½	25/−	— 5 4 0
Ericsson Tel.	5/−	25	25*	1 1/16	−¾ 3 14 1
Ever Ready	5/−	35	45	24/6	−1/− 9 3 8
Ferranti Pref.	1	7	7	25/−	−½ 5 12 0
G.E.C. Pref.	1	6½	6½	32/6	— 4 0 0
Do. Ord.	1	15	17½	69/−	−1/− 5 1 9
Henley's	5/−	30	15	16/3	— 4 12 4
Do. 4½% Pref.	1	4½	4½	1½	— 4 0 0
India-Rubber Pref.	1	5½	5½	21/3	— 5 3 6
Johnson & Phillips	1	½	10	36/3	−2/− 5 11 1
Lancashire Dynamo	1	20	25	2¾	−½ 8 14 0
Siemens Ord.	1	6	7½	26/3	−¼ 5 14 1
Telegraph Construction	£1	7½	10	37/6	−¼ 5 6 8

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1936

14514. "Cathode-ray television apparatus." Radioakt. Ges. D. S. Loewe. May 22nd, 1935. (480521.)

14776. "Finely sensitive relays." Soc. Savoisienne de Constructions Electriques. May 24th, 1935. (480671.)

17209. "Electrolytic process and apparatus for the degreasing and/or pickling of sheet or strip metal." H. A. Fosburg. June 20th, 1936. (480352.)

17243. "Occulters for arc searchlights." C. E. Clouston and Sperry Gyroscope Co., Ltd. June 20th, 1936. (480353.)

17637. "Cathode-ray tubes for television." Radioakt. Ges. D. S. Loewe. June 25th, 1935. (480672.)

17663. "Television apparatus." W. H. Priess. July 13th, 1935. (480673.)

19944. "High-tension supply circuits for electron-discharge devices." A. D. Blumlein and R. E. Spencer. July 18th, 1936. (480355.)

20445. "Electric-discharge lamps comprising material adapted to be excited to luminiscence by an electric discharge." General Electric Co., Ltd., A. H. McKeag and J. T. Randall. July 23rd, 1935. (Cognate applications 34284/36, 5694/37, and 12704/37.) (480356.)

20603. "Coupling circuits for use in high-frequency systems." B. J. Banfield. July 25th, 1936. (480680.)

22813. "Indicating apparatus." Marconi's Wireless Telegraph Co., Ltd. August 19th, 1935. (480441.)

23116. "Television apparatus." British Thomson-Houston Co., Ltd., and S. R. Eade. August 22nd, 1936. (480532.)

23118. "Reduction gears particularly for electrical tuning devices." Standard Telephones & Cables, Ltd. (L. van Bulck). August 22nd, 1936. (480534.)

23138. "Variable condensers." H. M. Oberlander. August 22nd, 1936. (480537.)

23218. "Electric transformers." British Thomson-Houston Co., Ltd. August 31st, 1935. (480443.)

23225. "Electric signalling systems." General Electric Co., Ltd., and D. A. Ley. August 24th, 1936. (480444.)

23240. "Electrical controlling systems." Automatic Electric Co., Ltd. (in liquidation) and J. F. Mackenzie. August 24th, 1936. (480603.)

23280. "Electric fuse fittings." V. Hope. August 25th, 1936. (480690.)

23288. "Electron-discharge devices." Baird Television, Ltd., and V. Jones. August 25th, 1936. (480691.)

23334. "Rail vehicle signal systems." Lowell-Wintsch Automatic Train Control, Inc. August 26th, 1935. (480694.)

23448. "Electrically operated switch mechanism." A. G. Kershaw, N. G. Kershaw, and Westinghouse Brake & Signal Co., Ltd. August 26th, 1936. (480703.)

23464. "Method and apparatus for testing radio valves." S. R. Wilkins, and Automatic Coil Winder & Electrical Equipment Co., Ltd. August 26th, 1936. (480752.)

23524. "Electric remote metering arrangements." A. Reyrolle & Co., Ltd., F. N. Linstow and F. G. Rutter. August 27th, 1936. (480708.)

23577. "Microphone arrangements for oxygen and like face masks." Marconi's Wireless Telegraph Co., Ltd., and J. Stewart. August 27th, 1936. (480710.)

23578. "Cathode-ray tubes." Marconi's Wireless Telegraph Co., Ltd., and N. Levin. August 27th, 1936. (480711.)

23591. "Oscillation generators for scanning or like purposes." Ferranti, Ltd., and J. C. Wilson. August 28th, 1936. (480754.)

23593. "Electrical condensers." J. J. V. Armstrong (R. Bosch Akt.-Ges.). August 28th, 1936. (480713.)

23636. "Means for varying the selectivity of a radio receiving-set." General Electric Co., Ltd., and W. H. Peters. August 28th, 1936. (480755.)

23684. "Control and/or signalling systems for use on railways or the like." Automatic Electric Co., Ltd. (in liquidation), and L. M. Simpson. August 28th, 1936. (480719.)

23720. "Apparatus for measuring the properties of liquids, the electrical conductivity of which varies with said properties." W. Crockatt & Sons, Ltd., and W. C. Crockatt. August 29th, 1936. (480542.)

23722. "X-ray contrast media and the production of X-ray photographs." W. P. Williams (Schering-Kahlbaum Akt.-Ges.). August 29th, 1936. (Addition to 465994.) (480721.)

23765. "Electric motor control systems." Westinghouse Electric & Mfg. Co. August 31st, 1935. (480761.)

23794. "Mounting of high-frequency tuning elements." Marconi's Wireless Telegraph Co., Ltd. August 31st, 1935. (480724.)

23824. "Moving-coil electrical-recording instruments." Elliott Bros. (London), Ltd., D. C. Harben and C. F. Pizzy. August 31st, 1936. (480726.)

23855. "Annunciators." Instanta Electric, Ltd., G. C. H. Clayton and H. A. Thompsett. August 31st, 1936. (480449.)

24235. "Electric motor control systems." General Electric Co., Ltd., E. H. Croft and J. C. Turrall. September 4th, 1936. (480453.)

25034. "Means for delaying the response of electro-magnetic switches." A. West and Co., Ltd., and V. Breeze. September 14th, 1936. (480455.)

25035. "Squirrel-cage synchronous electric motors." Croydon Engineering Co., Ltd., P. S. Firmin and C. F. E. Payne. September 14th, 1936. (480618.)

26322. "Electrical cut-out for use in connection with electrically heated liquid containers." Universal Boilers and Engineering Co., Ltd., and T. Fletcher. September 29th, 1936. (480620.)

28391. "Electrical fuse-boards and other apparatus in which fuses are used." J. A. Crabtree and Co., Ltd., H. F. McLoughlin and B. G. Harrison. October 19th, 1936. (480458.)

28684. "X-ray apparatus." W. Watson. October 22nd, 1936. (480459.)

28884. "Electric switches having gas blast quenching of the arc." F. Strauss (née Ruppel). October 23rd, 1936. (Convention date not granted.) (480377.)

29051. "Thermionic valve amplifiers and the like." General Electric Co., Ltd., and L. I. Farren. October 26th, 1936. (480378.)

30249. "Electric circuit-breakers." G. Ellison and J. Anderson. November 6th, 1936. (480462.)

32676. "Liquid-level gauges and other electrically operated instruments." U. J. S. Russell. November 28th, 1936. (480391.)

32797. "Electric couplings." General Electric Co., Ltd., and J. Lanham. November 30th, 1936. (480466.)

1937

137. "Electric plug connections." N. Allday and R. Bain. January 2nd, 1937. (480477.)

1235. "Anodes for use in electro-depositing operations." W. Canning & Co., Ltd., and G. A. Pope. January 15th, 1937. (480547.)

4299. "Television systems." Standard Telephones & Cables, Ltd. July 23rd, 1936. (480483.)

5279. "Circuit arrangements for measuring very high potentials or for rendering such potentials effective in apparatus designed to operate at low potentials." Siemens & Halske Akt.-Ges. February 22nd, 1936. (480485.)

5822. "Carrier-wave signalling systems." Standard Telephones & Cables, Ltd. March 6th, 1936. (480548.)

7755. "Electric gas-blast circuit-breakers." F. Strauss (née Ruppel). March 16th, 1936. (480405.)

7812. "Electric-discharge tubes." E. Jacobsen. March 17th, 1937. (480491.)

9608. "Electric watches." Soc. Auxiliaire pour le Developpement d'Industries Mécaniques (S.A.D.I.M.). April 10th, 1936. (480407.)

11806. "Electrical heating." G. H. C. Roux. May 12th, 1936. (480560.)

13871. "Machines for winding string around wrapped cylindrical bobbins for electric batteries." Schweizerische Industrieges, and F. Reichembach. May 18th, 1937. (480501.)

14649. "Rotary machine adapted for use as a motor pump, a motor-compressor or electric generator." Rotative Mechanisms, Ltd. May 26th, 1936. (480738.)

15413. "Electric circuit-breakers having arc extinguishing arrangements." Westinghouse Electric & Mfg. Co. June 3rd, 1936. (480569.)

15440. "High-frequency signal amplifiers." Philco Radio & Television Corpn. July 3rd, 1936. (480417.)

16895. "Direction-finding radio receivers." Telefunken Ges. für Drahtlose Telegraphie. June 20th, 1936. (480572.)

19355. "Suspension ears for trolley conductors of electric traction systems." T. M. Watson. July 13th, 1937. (480575.)

19849. "Electrically operated inertia starters for internal-combustion engines. Blackburn Aircraft, Ltd., and C. S. Napier. July 17th, 1937. (480576.)

19906. "Ultra high-frequency radio systems." Marconi's Wireless Telegraph Co., Ltd. July 18th, 1936. (480577.)

21042. "Electric terminal structures." British Thomson-Houston Co., Ltd. July 29th, 1936. (480510.)

21045. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. July 29th, 1936. (480511.)

21185. "Television systems." Standard Telephones & Cables, Ltd. September 17th, 1936. (480646.)

21906. "Electrical phase and polarity reversing networks." Marconi's Wireless Telegraph Co., Ltd. March 10th, 1937. (480424.)

22282. "Switching system for the temperature regulation of electrical heating apparatus." Landis & Gyr Akt.-Ges. September 10th, 1936. (480648.)

24891. "Dielectric materials and methods of making the same." British Thomson-Houston Co., Ltd. September 12th, 1936. (480650.)

25511. "Automatic installation switch with bi-metal release.' Stotz-Kontakt Gesellschaft. September 21st, 1936. (480655.)

25875. "Screening devices for thermionic valves and the like." A. F. Bulgin & Co., Ltd., and A. F. Bulgin. September 23rd, 1937. (480744.)

31761. "Electric heating elements." British Thomson-Houston Co., Ltd. November 18th, 1936. (480665.)

32720. "Holders for piezo-electric crystals." Standard Telephones & Cables, Ltd. January 30th, 1936. (Divided out of 615/37.) (480666.)

34920. "Electron-discharge arrangements." Marconi's Wireless Telegraph Co., Ltd. October 28th, 1935. (Divided out of 29345/36.) (480667.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 16th:—

Antidax. No. 583323. Class 8. Electric cables.—Asea Electric, Ltd., Fulbourne Road, Walthamstow.

Artolac. No. 580111. Class 50. Mouldable synthetic resinous materials in powder, lump, flake filament and granular form and articles made therefrom.—Julian P. Fraser, "Ravensbrook," Oxted, Surrey.

Piezo Crystals Defined

A ten-page pamphlet, with four diagrams and a bibliography, emanating from the National Physical Laboratory (H.M. Stationery Office, price 3d. net), standardises a method of defining the orientation, shape and size of discs and rectangular plates cut from quartz crystals. There has been a long-felt need for some such official lead to the abatement of the confusion of nomenclature that has grown up as the result of the increasing diversity of uses to which the electromechanical properties of crystalline quartz are being put nowadays.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Houses (128), Middlefield, Kaimhill and Bridge of Dee; burgh surveyor. Houses (44), west of Springfield Road; R. Milne, Ltd., builders.

Acton.—Houses (200), Vale site; borough engineer.

Addington.—Houses (125), Aldrich Crescent; First National Housing Trust, Ltd. Houses (33), Eversley Way; Bennett & Worksett.

Altrincham.—Social centre, Oldfield Brow estate (£9,000); W. J. Brown, borough surveyor, Town Hall.

Ashford.—Cinema, Church Road, for M.G.Y., Ltd.

Ashton-under-Lyne.—Houses, Nook Lane, Holden Street, and Raynor Lane site, for the Housing Committee; W. Wilson, surveyor, Town Hall.

Bebington.—Houses (104), Town Lane estate; Boultons (Bebington), Ltd.

Birmingham.—Buildings for the Birmingham Commercial College, Broad Street.

Bishop Auckland.—Houses (48), for the North-Eastern Housing Association; Crawford and Robson, architects, Market Chambers, Bishop Auckland.

Blackburn.—School, Shakespeare Hill (£23,100), for the E.C.

Blackwell.—Houses (28), and bungalows, Tibshelf; C. H. Hill & Sons, Ltd., contractors, Victoria Street, Mansfield.

Bournemouth.—Houses (30), Wimborne Road; A. C. Barnes.

Bordesley.—Factory, Bordesley Green Road; Russell Building & Construction Co., builders, Princess Street, Manchester.

Bristol.—Abattoirs, Gordon Road (£30,000), for Bristol and District Co-operative Society, Ltd.; staff architect.

Canterbury.—Houses (48), Reed Avenue; city surveyor.

Cheshire.—School, Bredbury, Stockport, for the County E.C.; Jonathan Partington, Ltd., builders, Middleton Junction, Middleton, near Manchester. School, Broadway, Cheadle, for the County E.C.; Thomas Davies & Son (Contractors), Ltd., Turncroft Road, Stockport. School, Lymm, for the County E.C.; F. Anstead Browne, county architect, The Castle, Chester.

Cleadon (Co. DURHAM).—Sports stadium for White City (Newcastle), Ltd.; T. H. Turnbull, architect, "Seacroft," Blackhall Rocks.

Coventry.—Houses (30), Eversleigh Road; W. R. Lane & Son, Ltd., builders, Fisher Road. Houses (35), Middlemarch Road; A. Jervis, builder, Holyhead Road.

Croydon.—Houses (32), Aldersmead Avenue; W. & H. West, Ltd. Dwellings (24), Leighton Street redevelopment area; borough engineer, Town Hall.

Darlington.—Houses (24), Meadowfield Road; Bussey and Armstrong, builders, Brinkburn Road.

Dartford.—Houses (18), Ross Close; Smith & Hares.

Droylsden.—Houses (30), Manchester Road, Fairfield; C. F. Napper, builder, 91, Station Parade, Harrogate.

East Ham.—Houses (77), Bonny Downs; A. T. Bridgewater, borough engineer, Town Hall, E.6.

Edinburgh.—School (£45,000); city architect.

Exeter.—Alterations and additions to St. Luke's College; governors.

Farnworth.—Houses (86), Worsley Road (£28,840); U.D.C. surveyor.

Folkestone.—Houses (26), Taylor Road; borough surveyor.

Fleetwood.—Houses (66), Flakefleet estate; borough surveyor.

Gateshead.—Two factories, Team Valley Trading estate; W. and T. R. Milburn, architects, 17, Fawcett Street, Sunderland.

Glasgow.—Houses (111); J. Dickie & Sons, Ltd., builders.

Grantham.—Houses (90), Cherry Orchard; borough surveyor, Guildhall.

Guildford.—Houses (28), Shere, Normandy and Seale; J. W. Wilton, R.D.C. surveyor, Millmead House, Guildford.

Hemsworth (NEAR PONTEFRACT).—Houses (100), South Elmsall; W. T. Lynam, engineer and surveyor to the Council, Market Chambers, Hemsworth.

Hertfordshire.—School, Russell Lane, Barnet (£54,479), for the County E.C.

Heywood.—Houses (89), Corry Street to Chadwick Lane; J. Berry, Ltd., Chapel Street.

Horbury.—School, Grimethorpe, for the E.C.; H. Wormald, education architect, Education Offices, Wakefield.

Hove.—Houses (24), Sunninghill Avenue; G. Comber.

Hoyland Nether.—Houses (40) and bungalows and recreation room, Stead Lane site; J. R. Shephard, U.D.C. surveyor.

Ireland.—(GLASNEVIN, DUBLIN).—Schools, Glasnevin, for Christian Brothers, Dublin; J. W. O'Sullivan, architect and engineer, 104, Grafton Street, Dublin. (RATHMINES, DUBLIN).—School, Rathmines; J. J. Robinson and R. C. Keefe, architects, 8, Merrion Square, Dublin.

Lanchester.—Houses (46), Esh Village, for the North-Eastern Housing Association; E. Simpkin, architect, Council Offices.

Leeds.—Houses (64), Hillcourt Drive, Bramley; T. E. Feather. Houses (14), near Westover Road, Bramley; Appleyard Bros.

Litherhead.—Town hall (£25,100); U.D.C.

Liverpool.—Houses (52), North Barcombe Road and Barnhurst Road; Thomas Jones & Son, Ltd., 3, Childwall, Priory Road.

London.—(KENNINGTON).—Flats, Blythe estate (£14,000); L.C.C. architect, County Hall, Westminster Bridge, S.E.1. (SOUTHWARK).—Rehousing, Barlow Street area (£57,000); L.C.C. architect. Tenements, Orb Street (£11,472); A. T. Rowley, Ltd.

Manchester.—Houses (97) near Victoria Avenue East, Blackley, for Greenwood & Tyson, Victoria estate, Rochdale Road; P. G. Kelvey, architect, 379, Moss Lane East, Manchester, 14. Cinema, Church Street, Newton Heath, for the Magnet Cinema Co., Ltd., 13, St. Ann's Street, Manchester; Moston Brick and Building Co., Ltd., contractors, Kenyon Lane, Moston. Bus garage, Wythenshawe (£104,500), for Transport Committee, and residential school, Soss Moss; city architect.

Mansfield Woodhouse.—Houses, Oxclose Lane, and Forest Town (George Street); L. Walker, U.D.C. surveyor, Council Offices, Manor House.

Middlesbrough.—Additions to Municipal hospital; borough engineer.

Middleton.—Schools, Alkrington (£16,000), and Durnford Street (£17,500); borough architect.

Newcastle-on-Tyne.—Maternity block (£27,000); E. Thompson, builder, 12, Grey Street.

Normanton.—Houses (98), Dodsworth Hill (£21,531); U.D.C. surveyor.

Nottingham.—Extensions to Nottingham Hospital for Women (£40,000); secretary.

Perth.—School (£31,000), Viewlands, for the E.C.; architect, County Council, Perth.

Portsmouth.—Extensions to works, for J. H. Sparshatt & Son, London Road, Hillsea.

Port Talbot.—Carbide factory for British Oxygen Co., Ltd.; Heron Rogers & Partners, architects, 181, Queen Victoria Street, London, E.C.4.

Preston.—Houses, Faringdon and Thirlmere estates (£105,000); borough engineer.

Redcar.—Fire station, for the T.C. (£15,000); borough engineer.

Renfrew.—Business premises (£22,000); Equitable Co-operative Society, Ltd.

Renfrewshire.—School, Eaglesham (£20,000), for the County E.C.; county clerk, Paisley.

Rothwell.—Houses (72), Robin Hood site; U.D.C. surveyor.

Rottingdean.—Flats, Marine Drive; C. W. Edwards.

Rushden.—Extensions to factory, for Sanders & Sanders, Ltd., Spencer Road.

Scarborough.—Offices, for the Scarborough Building Society; Marshall and Sons, builders, Gladstone Lane, Scarborough.

Seaton Valley.—Houses (100), Packworth Station site (£69,000); U.D.C. surveyor.

Sevenoaks.—Houses (49), Castle Farm estate, Otford; F. Jarvis, Golding Road.

Shotts.—Cinema, for Broxburn Enterprises, Ltd.; R. McKay, 4, Melville Street, Edinburgh.

Southampton.—Cinema, Swaythling High Road, for Palladium (Southampton), Ltd.; Sutcliffe, Taylor & Farmer, architects, 5, Manchester Square, London, W.1.

Spenborough.—Houses (20), Birkenshaw; A. Rothera, architect, Church Street, Cleckheaton.

Stanley.—Houses (276), Outwood Hall, Wrenthorpe and Stanley Ferry; U.D.C. surveyor.

Stockton-on-Tees.—Houses, Highfield Crescent, for H. and R. B. Bainbridge; T. W. T. Richardson, architect, 57, High Street. Cinema, Norton Avenue, Norton; Superb Cinema Co.

Stoke.—Cinema, Stone Road, Trent Vale, for T. Pointon; Adam & Edwards, architects, Stafford Chambers, Glebe Street. Houses (1,158), £576,654; city architect.

Tendring.—Council offices, board room and committee rooms, Weeley (£7,800); R.D.C. surveyor.

Thingoe.—Houses (56), £22,980); R.D.C. surveyor.

Trimdon (Co. DURHAM).—Houses (110), for the North Eastern Housing Association; W. Forster, Ltd., builders, Bowburn.

Tunbridge Wells.—Houses (158), Oak Road estate; borough surveyor.

Tyldesley.—Houses (184), Astley; U.D.C. surveyor.

Tynemouth.—Factory, Norham Road; Welch & Sons, Ltd.

Urmston.—Houses (130), various sites, Urmston, Flixton and Davyhulme; E. L. Leeming, U.D.C. surveyor, Council Offices.

Walsall.—Extensions to works, for J. Hawley & Co., Ltd., Bloxwich Road.

Wednesbury.—Houses (88), Old Park estate (£69,485); borough engineer.

Wellingborough.—Bus garage, St. John Street; United Counties Omnibus Co.

Wellington (SOMERSET).—Houses (36), three contracts, Rockwell Green; E. T. Howard, architect, 67, High Street, Wellington.

West Ashford.—Houses, Bethersden, Charing, Pluckley, Westwell, Charing Heath, Great Chart, Little Chart, Egerton, Kingsnorth, Smarden and Shadoxhurst; E. A. Jackson, architect.

West Lothianshire.—Schools, Armadale (£5,000) and Stoneyburn (£13,000); county clerk, Linlithgow.

Wideopen (NORTHUMBERLAND).—Cinema, Wideopen, for Wideopen Cinema Co.; E. Thompson, contractor, 12, Grey Street, Newcastle-on-Tyne.

Worthing.—Cinema with shops, Sea Lane, Rustington; R. E. Hawkins, architect, 6, Liverpool Terrace.

Yorkshire.—Schools, Northallerton and Normanby, for the North Riding C.C.; architect, Northallerton.

Civil Engineers' Dinner

At the annual dinner of the Institution of Civil Engineers in London on March 15th Mr. S. B. Donkin, president, in replying to the toast of "The Institution," which had been proposed by the Minister of Transport, took the opportunity of asking the Minister to form an expert committee to re-examine the water-power resources of Great Britain in order to establish the total cost of the production of power from such sources and to compare it with the total cost of the production of power by steam plant, now that coal and labour costs were rising. That would be desirable, in his opinion, for industry generally, and in particular for the metallurgical, mechanical and iron and steel industries. He asked also whether it was not desirable to standardise the lower voltage for electricity supply to consumers when new legislation was shortly to be introduced in respect of distribution.